CHAPTER IV
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter contains the scientific and analytical foundation for comparisons between the alternatives. The alternatives are designed to define issues sharply and provide a clear basis of choice. Alternative effects comparisons in Chapter II are based on this information.

A number of people commented that the Draft Environmental Impact Statement (DEIS) contained inaccurate, bad, or no scientific basis. Most such statements were accompanied by a statement of opposition to the DEIS preferred alternative. An Environmental Impact Statement (EIS) is not a scientific document per se (40 CFR 1500.4(i)). It is not necessary to repeat the entire volume of detail on a particular subject, and it is encouraged to cite literature or tier to other analyses to the greatest degree possible to reduce the bulk of a document (40 CFR 1500.4(i) and (j)). An EIS is intended to disclose environmental effects over a range of alternatives. It is meant to provide enough information, both qualitatively and quantitatively, to display the relative differences among the alternatives in subject areas most pertinent to the decision to be made (40 CFR 1500.4(f)). The scientific integrity of an EIS is demonstrated by disclosing methods of analysis, defining terms and assumptions, and making explicit references to sources of information used (40 CFR 1502.24). Council on Environmental Quality (CEQ) Regulations allow an EIS to proceed even if there is incomplete or unavailable information, and specifies processes by which to do this (40 CFR 1502.22).

This chapter first explains the methods and assumptions used for all resource impact topics. Then for each alternative, it discloses direct and indirect environmental effects for the range of resource impact topics, including effects on the human environment (social and economic). The final part of the chapter consists of separate summary discussions of effects for all alternatives, including:

- Cumulative impacts
- Effects on adjacent lands
- Adverse effects that cannot be avoided
- Irreversible or irretrievable commitments of resources
- The relationship between short-term uses of the environment
- Maintenance and enhancement of long-term productivity.

The estimated costs of the alternatives are not considered an impact topic. Appendix F provides relative costs of the alternatives.

CEQ regulations for the National Environmental Policy Act (NEPA) require that agencies determine the environmental issues related to a proposed action that are "deserving of study" (40 CFR §1500.4, §1501.7), and discuss them in proportion to their significance (40 CFR §1502.2 (b)). This determination, and consequent level of discussion for each impact topic, is reflected in the *Affected Environment* chapter and is a necessary prelude to analysis.

The purpose and need for the proposed action is defined in Chapter I, along with a determination of the issues to be analyzed in depth based on the scope of the purpose and need (*Major Issues*). The issues to be analyzed in depth do not always correspond neatly to individual analysis topics because of analysis complexities and resource interrelationships. What follows is a guide to major issues and corresponding relevant and related topics in the effects analysis. Since alternatives were formulated to define the issues, this linkage is critical for the reader and the decision maker to see how alternatives address the purpose and need for action.

Table 54. Major issues.

Impacts of the Proposed Action on:	Impact Topics Related to Major Issue:
Visitor Use and Access	Visitor Access and Circulation
Visitor Experience	Visitor Experience; Air Quality and Public Health; Natural Soundscape; Public Safety
Air Quality	Air Quality and Public Health; Visitor Experience
Soundscape	Natural Soundscape; Visitor Experience
Human Health and Safety	Air Quality and Public Health; Public Safety; Visitor Experience
Local Economies	Socioeconomics
Natural Resources	Natural Resources – Geothermal; Water; Wildlife; Soundscapes

ASSUMPTIONS AND METHODOLOGIES FOR EVALUATING IMPACTS

This analysis includes a description of whether effects are beneficial or adverse, and short term or long term. The magnitude of the effect also is described in terms ranging from negligible to major. Effects disclosed may be direct or indirect. The definition of the level, or magnitude, of the impact may vary between impact topics, so individual definitions are provided for each. The following definitions apply in general to the effects analysis.

Table 55. Types of effects.

Impact Category	Definition
Beneficial effect	A positive change in the condition or nature of the resource, usually with respect to a standard or objective. A change that moves a resource toward its desired condition.
Adverse effect	A negative change in the condition or nature of the resource, usually with respect to a standard or objective. A change that moves a resource away from its desired condition.
Direct effect	An effect that is caused by an action and occurs at the same time and place.
Indirect effect	An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
Short-term effect	An effect that in a short time will no longer be detectable as a resource returns to its pre-disturbance condition. The period is generally less than 5 years.
Long-term effect	A change in a resource or its condition that does not return to pre-disturbance levels and for all practical purposes is considered permanent.

From an analysis standpoint there is a difference in types of effects relating to natural resources versus items such as public safety or public health. Applying the definitions of short-term or long-term effects to the public health is somewhat problematic. In most cases it is assumed that public health or safety risks would be affected directly by a management action, either improved or worsened. Therefore, the term or duration of effect is only as long as the management action is applied. This effect is, therefore, assumed to be short term since the action can be changed at any time to improve safety and health risks. Conversely, it is not reasonable to assume that an identified health or safety risk would be allowed to continue over the long-term.

For the rest of the analysis, including *Natural Resources*, all disclosed effects are considered short term unless otherwise stated. In most cases, the duration of the impact coincides with the duration of the action.

Socioeconomics

Introduction

The degree of impact can be quantified in some cases, such as when a model is used or data are obtainable. Often only qualitative descriptions of impact from specialists or scientific literature in similar cases are available. Table 56 defines the degree of impact when it cannot be quantified.

Table 56. Definition of impacts to socioeconomics.

Impact Category	Definition
Negligible	The impact is at the lower levels of detection.
Minor	The impact is slight, but detectable.
Moderate	The impact is readily apparent and has the potential to become major.
Major	The impact is severe, or if beneficial, has exceptional beneficial effects.

Summary of Regulations and Policies

NEPA's guiding regulations require analysis of social and economic impacts resulting from proposed major federal actions if an EIS is being prepared. In addition Executive Order 12898, dated February 11, 1994, "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*" requires federal agencies to assess the impact of actions on minority and low-income communities. Although there are no specific regulations requiring protection of social values, impacts on them are considered an important piece of the federal planning processes.

Assumptions and Methods

Between the last week of January and the first week of March 1999 winter visitors to Yellowstone National Park (YNP) and Grand Teton National Park (GTNP) were surveyed regarding their winter trips to the Greater Yellowstone Area (GYA) and their opinions about winter management of the national parks in the GYA. Chapter III describes key results of the survey. Economic parameters related to the regional economy generally were derived from the winter user study using regional economic input-output methodologies (Minnesota IMPLAN Group 1996). Also included in Chapter III is a discussion of the results for two additional surveys: a 1999 survey of summer visitors to YNP, and a national, regional, and local random household phone survey. Economic parameters related to nonmarket values were derived from the winter user study using contingent valuation model methodologies (Braden and Kolstad 1991; Mitchell and Carson 1989).

Methodology for Estimating Changes in Winter Visitation Associated with Socioeconomic Impacts

The primary source of data used to estimate winter visitation changes under different park management policies was the 1999 winter survey of winter visitors to YNP and the GYA (Duffield et al. 2000a). The following discussion focuses first on the information needed to estimate visitation changes, and then the mechanics of estimating changes from this information.

The following information was used to estimate impacts.

Total winter visitation to YNP, and GTNP, and the Parkway. This information provided by the NPS was based on 1998-99 data for the West and East Entrances of YNP as well as the Moose and Moran Entrances of GTNP, and 1997-98 data for the North Entrance of YNP. The 1997-98 data was used because of questions regarding the 1998-99 data, and because available information indicated that visitation had been relatively stable through the North Entrance for 1997-98. The visitation data for the Moran Entrance of GTNP was derived in three steps:

1. Adjusting the total December through March 1998-99 car counter data for the portions of December and March not included in the winter season analysis;
2. Reducing the car count by an estimate of 25% non-recreational entries;

3. Multiplying the result by an estimated 2.4 people per vehicle.

The estimate of visitors at the Moose Entrance was provided by GTNP as the sum of skiers, snowmobilers, and an estimate of 60% of backcountry user-nights accessed through this entrance (Terri Roper, pers. com., 2000). An estimated 117,666 visitors entered GTNP at the Moose Entrance. Because some visitors enter the parks more than one time on their trip to the area, the trip estimate is based on the total entrance count reduced by 25% (Sacklin, pers. com., 1998). Therefore the estimated baseline visitation level is 88,250 individual trips (including multi-day trips) to the parks between mid-December and the second week of March.

Percent of visitors from outside the analysis area. There were two analysis areas in this study: the five contiguous counties surrounding the parks (Fremont, Idaho; Gallatin and Park, Montana; and Park and Teton, Wyoming), and the three-state region of Idaho, Montana, and Wyoming. The survey of winter visitors to the parks found that 85.9% of winter visitors were from outside the five-county area, and 65.5% were from outside the three-state region. A 17-county area was evaluated in the DEIS and refined to five counties at the request of cooperating agencies.

Estimated percentage change in the number of trips to the parks. The winter visitor survey addressed four possible policy changes in park winter access management (Duffield et al. 2000a). The survey questions asked visitors how they would change their anticipated visitation to the 17-county GYA in the winter months under different management policies. To arrive at an estimated percentage change in trips, the responses of individuals who said they would take either more trips or fewer trips were compared to the baseline number of anticipated trips to the GYA. Two specific adjustments were made:

1) A very small number of individuals from distant states (New Jersey, Pennsylvania, or Alaska) who stated that they took an implausibly high number of trips from home to the GYA during the 120-day winter season (25, 30, or 50 trips) were excluded from the analysis.
2) A 120-day threshold was set for the winter visitor season. If a respondent indicated that the threshold would be exceeded by additional visits to GYA, the response would be excluded. For this reason, one response was excluded from the sample.

Total spent per trip within the analysis area. The 1999 winter visitor survey asked respondents how much money they spent on their trip to the GYA. The survey also asked the respondents to divide their total trip spending and estimate how much was spent in the 17-county GYA verses the three-state region. These responses were analyzed to calculate the average trip expenditure in the 3 states and in the 17-county GYA for individuals that said they would increase their number of trips and those who said they would decrease their trips. Spending was calculated on this disaggregated level to capture any possible differences in trip spending between those who would increase or decrease visitation under a policy change.

Percent of the nights spent in the five-county analysis area. The winter visitor survey asked respondents how many nights they spent in each of 19 towns in the 17-county GYA. To estimate impacts on the smaller five-county area it was assumed that spending would closely follow overnight stays. It was found that 85% of the overnight stays detailed by winter survey respondents were spent in the five-county area.

Sampling Methodology and Adjustments to Sample Data

The sampling design for the winter user survey was based on the distribution of winter use among five park entrances (YNP North, East, and West, and GTNP Moose and Moran) during winter 1997-98. The sampling rate at the East Entrance was intentionally doubled to yield more complete surveys from this lightly used entrance.

In the course of conducting consistency checks on the final winter survey database, it was discovered that the sample allocation among the GTNP entrances was weighted too heavily toward the Moose Entrance. The 1997-98 winter visitation statistics used for this entrance included a substantial number of non-recreational visits. Since visitors through the Moose Entrance are predominantly cross-country skiers, this sampling bias resulted in an overrepresentation of skiers relative to snowmobilers in the sample. To correct for this, the responses of GTNP skiers and snowmobilers were weighted in the final analysis to reflect the true proportion of these groups in the winter visitor mix to GTNP.

Estimation of Visitation Impacts

The estimates of changes in direct visitor spending were calculated using the following steps for each of the two analysis areas (five-county and three-state), and for each of the four management changes:

1) Total winter visitation (88,250) was multiplied by the percent of visitors coming from outside the GYA three-state region.
2) The resulting visitation from outside the impact area was multiplied by the estimated percentage change to the number of trips as calculated from the responses to the YNP winter visitor survey. This estimated percentage change in visitation took into consideration the responses of those who said they would decrease their visitation under an alternative as well as the responses of those who said they would either increase visitation or not change their visitations to the area.
3) The respective reduction and increase in trips were multiplied by the mean trip expenditure to the impact area for those who said they would decrease or increase trips, respectively.
4) The resulting estimated increase and decrease in trip expenditures were summed to arrive at an estimated change in visitor expenditures.
5) The change in trip expenditures was input into an IMPLAN regional economic model of the impact area to estimate the indirect and induced expenditure impacts resulting from the estimated direct expenditure impacts.
6) Direct, indirect, and induced expenditure impacts were summed to arrive at total estimated expenditure impacts for each management option and impact area.
7) Total estimated expenditure impacts were compared against the total impact area economic baseline to arrive at an estimated percentage change in economic activity (output or employment) for the area.

In addition to the survey data described in the Chapter III, the cooperating counties and states supplied a substantial number of local economic reports and associated data. These reports were reviewed and, where appropriate, incorporated into the following analysis. Appendix A contains a list of the documents supplied by the cooperators and reviewed in preparation of this document.

The five-county GYA and three-state region were used for the socioeconomic impacts analysis of alternative management actions. The primary economic impact associated with the winter management alternatives concerns actions that are likely to change winter park visitation levels. Estimated expenditure impacts on an area from reduced tourism depend on 1) the percentage of visitors to a park, for example, that come from outside the impact analysis area, and 2) the amount of their total trip expenditures that are spent within the impact analysis area. The percentage of visitors from outside the analysis area decreases as the size of the analysis area increases, while the percentage of their total trip expenditures spent within the analysis area increases as the analysis area increases. The five-county analysis area was chosen to represent the counties and communities where most of the economic activity related to YNP and GTNP occurs. This change from the DEIS, which evaluated a 17-county area, was made at the cooperating agencies' request.

The estimated impacts associated with the alternatives are presented as impacts on the specific analysis areas (five counties or three states). It is important to recognize, however, that these analysis areas are not economically homogeneous, and any impacts associated with alternative management actions would not be distributed evenly across the analysis areas (see also *Socioeconomics of the Regional Economy*, Chapter III). The counties and communities closest to the parks (specifically communities such as West Yellowstone and Gardiner, which are heavily tourism dependent) would be much more heavily impacted than more distant, larger, and more economically diverse communities within the five-county area such as Bozeman or Jackson.

The following analysis of socioeconomic impacts to the five counties presents *net* impacts to the five-county area. No specific estimates are made of shifts in visitation and associated visitor spending within the GYA. It is likely that under alternative B for example, there would be a shift in snowmobile related winter visitation from the West Entrance of YNP to other areas such as the South and North Entrances. Consequently, part of the lost tourism spending within the West Yellowstone economy would be gained by Teton County, Wyoming and Gardiner and Cooke City, Montana.

Estimated impacts related to social effects and attitudes relied on standard methods in the social sciences, including survey research and various standard statistical techniques.

Air Quality and Public Health

Visitors and park staff report haze, odors, and health-related issues from emissions in areas where snowmobiles congregate (GYCC 1999). The EPA currently does not regulate snowmobile emissions although it has recently indicated that regulations on

snowmobiles will be proposed by September 2000 (EPA 1999). Such proposed rules and regulations often require years before they can be implemented. Studies in YNP, GTNP, and in laboratories analyzing the emissions of snowmobiles and the impacts of the emissions on the environment and human health have shown that most wheeled-vehicles are less polluting than 2-stroke engines (Snook and Davis 1997). The use of bio-based fuels and biosynthetic lubricants, proper engine set up (such as tuning the snowmobile engine for the elevation), and other 2-stroke engine technologies have shown to have moderate reductions in emissions (White and Carrol 1998).

Increased recreational visitor use contributes to concerns about the impacts on air quality from increased use of 2-stroke engines. Weather conditions, higher elevations, and large numbers of visitors using snowmobiles contribute to concentrated pollution at YNP (GYCC 1999). Destination areas such as Old Faithful, and road segments with greater traffic such as the road from the West Entrance to Old Faithful often experience problems with air quality. Visible adverse impacts (haze and odor) to air quality are short term, depending upon the location and environmental factors such as wind. Studies are underway to understand the long-term impacts of high polluting emissions on environment and human health. The results of these studies are summarized in Chapter III.

Modeling Methodology

To assess the relative impacts of the proposed winter use alternatives on ambient air quality in the GYA, short-term air quality analyses were performed by means of atmospheric dispersion modeling for carbon monoxide (CO) and particulate matter (PM_{10}). Table 57 summarizes six locations that were selected for the analyses based on visitor activities and vehicle mix as specified in alternatives A through G. The air quality study includes the inherent uncertainties of the model and the temporal and spatial biases due to limited meteorological and emission data. The modeling input and output data are presented in a separate report (EAEST 2000).

Table 57. Selected locations for modeling application.

Location	Type
West Yellowstone Entrance	Tollbooths
Old Faithful Staging Area	Staging area
Flagg Ranch Staging Area	Staging area
Mammoth to Northeast Entrance	Plowed highway
West Entrance to Madison	Groomed motorized route
Flagg Ranch to Colter Bay	Groomed motorized trail/plowed road

For the West Entrance to YNP and the roadway links, the EPA model CAL3QHC (EPA 1995a) was used to predict the maximum hourly average concentrations of CO and PM_{10}. In addition persistence factors were applied to the results to estimate maximum 24-hour average PM_{10} concentrations and maximum 8-hour average CO concentrations. For the

staging areas, the EPA model ISCST3 (EPA 1995b) was used to predict the maximum hourly and 8-hour average CO concentrations and maximum hourly and 24-hour average PM_{10} concentrations. The predicted maximum concentrations of CO and PM_{10} attributed to traffic conditions of the alternatives were then compared to those of the existing traffic conditions (no action alternative) to determine the amount and direction of changes in CO and PM_{10} concentrations. The contribution of each vehicle type to the generation of CO and PM_{10} was also assessed.

The visibility assessment was conducted following the procedures outlined in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA 1992). These procedures are designed to analyze the visibility impacts of plumes from industrial stacks. The winter use visibility analysis requires the assessment of line and area source emissions. The analysis techniques were adapted to meet this requirement using virtual point source methods.

West Yellowstone Entrance

Two tollbooths or kiosks are present at the West Entrance to YNP where snowmobiles and snowcoaches idle when entering the park to pay fees and obtain information. This creates stop-and-go, delay, and queuing traffic conditions. In addition an express lane exists at a third tollbooth in which traffic is designed to be freer flowing. To model the air quality impact of these traffic conditions, the EPA air quality model CAL3QHC was used. CAL3QHC predicts concentrations of inert pollutants from both moving and idling motor vehicles at roadway intersections. It includes the line source dispersion model CALINE3 (Benson 1979) and a traffic algorithm for estimating vehicular queue lengths at signalized intersections. Even though the West Entrance is not a signalized intersection, it presents the characteristics of one (e.g., delay approach, idle, and acceleration). The CAL3QHC model requires meteorological, site geometry, traffic, and emission parameters and data as critical inputs. Only the morning case was considered since it represents the most limiting traffic scenario occurring on a daily basis (DEQ 2000). A referential system with origin at the second or middle tollbooth was used to allocate the end points of the links and the receptor locations. Nine links representing the approach, queue, and departure links of each of the three lanes were defined. The end point coordinates of the links extend up to 1,000 feet for each link. Ten receptors were located outside the mixing zone, 200 feet apart along the northern and southern side of the entrance.

Using data from a February 2000 West Entrance snowmobile monitoring project (NPS 2000a) and the winter motorized average mean daily use (AMDU) scenarios (NPS 2000b), a methodology was developed to estimate the peak hourly traffic volume for each alternative. The traffic counts from the monitoring project indicate that the period between 9 A.M. and 10 A.M. represents the peak traffic hour, and that an average of 309 snowmobiles entered the park during that time. The average total daily entrance was 923

snowmobiles. This implies that about 33% of daily snowmobiles entered the park during the peak hour.

The winter motorized-use scenarios indicate that the ratio of the AMDU to the average peak day use of snowmobiles is 0.57 for alternative A (no action alternative). Assuming these percentages hold true for the other alternatives and for each vehicle type, the hourly peak traffic volume may be calculated as AMDU x 0.33/0.57, where AMDU is the average mean daily use. Videotapes recorded during the monitoring project indicate that the average idle time length at the two tollbooths is 30 seconds and the average approach speed is about 10 mph. Although the third lane was designed to be free flowing, it has been observed that on average motorists idle for about 5 seconds. For alternative G, it was assumed that no express lane exists and that all lanes have the same idle time of 30 seconds.

The composite wintertime CO and PM_{10} idle emission factors for the queue links and traveling emission factors for the approach and departure links were calculated based on the traffic volumes and the emission factor for each vehicle type. The traveling CO emission factors for automobiles, trucks, vans, and buses were obtained from the EPA emission factors publications for an average speed of 10 mph, high altitude location, and desired fuel type (EPA 1998a). The traveling PM_{10} emission factors for automobiles, trucks, vans, and buses were estimated from the EPA emission factor model PART5 (EPA 1995c) for an average speed of 10 mph, high altitude location, average fleet mix, and desired fuel type. For the Bombardier snowcoach, pre-1970 gasoline light-truck emission factors were used. Idle emission factors were obtained from the EPA idle emission factors publication (EPA 1998b). Since gasoline-fueled vehicle idle PM_{10} emissions are negligible, they were set to 0.001 grams/hour in the modeling inputs. The snowmobile emission factors were obtained from the Southwest Research Institute studies (White and Carroll 1999). An additional assumption was that 60% of all personal light-duty vehicles entering the park are light-duty trucks and 40% are automobiles.

Meteorological conditions considered for this analysis include low wind speed of 1 meter/second, stable atmosphere (class 6), and a low mixing height of 50 meters, which was derived from the average morning mixing height data for the Jackson Hole Airport during January and February 2000[30]. The ambient background concentrations of CO and PM_{10} were estimated following the guidelines of 40 CFR 51, Appendix W using available monitoring data collected from January 12 to March 28, 1995 in the town of West Yellowstone (NPS 1996a). They were estimated to be 3.0 ppm for 1-hour average CO and 23.0 $\mu g/m^3$ for 24-hour average PM_{10}. A surface roughness of 283.0 centimeters (cm) representing a fir forest was selected. Finally, for PM_{10} modeling, a settling velocity and deposition velocity of 0.5 cm/s were selected (Zanneti 1990).

[30] This scenario was used because the logical objective for this modeling effort is to replicate some conditions under which violation of a standard could reasonably be expected. These conditions are not unrealistic.

Roadway Segments

The selected road segments also were modeled using the CAL3QHC model. When executed without a queue link, CAL3QHC behaves like CALINE3, the recommended model for road segments. The first road segment selected is a 10 kilometers (km) stretch in YNP between the West Yellowstone Entrance and the Madison Junction, starting about 3 km from the West Entrance. It was subdivided into four short links because of directional changes in the roadway. The second road segment is also a 10 km stretch in GTNP between the Flagg Ranch staging area and Colter Bay Village, starting about 12 km south of Flagg Ranch. It contains an elevated groomed motorized trail for alternatives A, B, and C. Therefore, it was subdivided into eight short links, four for the main road and four for the adjacent trail. The third road segment is a 6 km stretch of road between Mammoth Hot Springs and Tower Roosevelt in north-central YNP, starting about 10 km east of Mammoth Hot Springs. It is characterized by wheeled-vehicle use only and was subdivided into four short links.

Within the model, receptors were placed on both sides of the road segment links outside the mixing zone, and meteorological conditions defined in the West Entrance scenario assumptions were used. The fleet mixes on the road segments were determined using the methodology explained in the West Entrance scenario. The composite wintertime traveling emission factors of CO and PM_{10} were calculated similarly to the West Entrance scenario, but for an average speed of 35 mph. The 24-hour average PM_{10} background concentration was integrated from the IMPROVE network data to be 5.0 $\mu g/m^3$. Because no CO monitor exists inside the park, the West Entrance 1-hour average CO background concentration was used. However, the West Entrance CO and PM_{10} background concentrations were used for the West Entrance to Madison junction road segment.

Staging Areas

The two staging areas modeled in this analysis were Old Faithful and Flagg Ranch. Old Faithful contains three main parking areas designed for visitors, while Flagg Ranch contains two main parking areas designed for visitors, guides, and outfitters. Compared to the West Entrance and the roadway segments, traffic in both staging areas is believed to be in idling or in slow-moving mode for relatively long periods. The staging areas were modeled as area sources using the EPA ISCST3 model. ISCST3 is a refined dispersion model based on the steady-state Gaussian plume equation designed to estimate concentration or deposition levels for each source-receptor combination. It requires source characteristics, source strength, hourly meteorological data, receptor locations, and terrain data as critical input data. In each of the two staging areas, a single area encompassing the major parking lots was drawn and used as the modeling area.

Based on the park official estimated number of vehicles present in the staging areas on a peak winter hour and the winter motorized average mean daily use scenarios (NPS 2000b), a methodology was developed to estimate the peak hourly traffic volume. It was assumed that the ratio of the average daily mean use of the roadways leading to the staging area for a given vehicle type to the total daily mean use was the same in the

staging area. It was also assumed that 20% of the machines are idling at Old Faithful, and that all machines idle for an average of 10 minutes at Flagg Ranch. The peak hourly vehicle number was then calculated by multiplying the peak vehicle population by the vehicle type ratio and the idle time. Moreover, for alternative G, the number of snowcoaches present in the staging areas was calculated by assuming that former snowmobile users would utilize the snowcoach fleet, and snowcoaches were assumed to be late model light-duty truck conversions.

The composite wintertime CO and PM_{10} idle emission factors were calculated similar to the West Entrance to YNP scenario. To obtain the hourly surface and upper air meteorological data required by ISCT3, the Jackson Hole Airport data for the winter months were obtained from the National Climatic Data Center and processed. In the model, a gridded receptor system was placed around the areas using a 100-meter spacing up to a distance of 1,000 meters. The 24-hour average PM_{10} background concentration was integrated from the IMPROVE network data to be 5.0 $\mu g/m^3$. Since no CO monitor exists inside the park, the West Entrance 1-hour average CO background concentration was used.

Impacts

The discussion of impacts of alternatives on vehicle emission exposure focuses on the exposure of employees, visitors, and snowmobile operators and riders to CO and PM_{10} worst-case air pollutant levels predicted by the air dispersion modeling. The intensity of an impact is categorized as negligible, minor, moderate, or major relative to alternative A, the no action alternative. For this analysis, the definition and intensity of the impact categories are summarized in Table 58. All impacts on air quality and public health are defined as short term (see introduction to *Assumptions and Methods for Evaluating Impacts*).

Table 58. Definition and intensity of impacts to air quality and public health.

Impact Category	Definition	Intensity
Negligible	The impact on public health is not measurable or perceptible.	<5%
Minor	The impact is measurable or perceptible and is localized within a relatively small area. However, the overall exposure would not be affected.	5-20%
Moderate	The impact is sufficient to cause a change in exposure, but remains localized. The change is measurable and perceptible but could be reversed.	21-50%
Major	The impact is substantial, highly noticeable, and may be permanent.	>50%

Visibility

Visibility impacts are assessed by whether the air pollution emissions from an alternative are likely to cause a visibility impairment that would be perceptible to an observer.

Screening threshold values described in the Workbook for Plume Visual Impact Screening and Analysis (EPA 1992) are used.

Public Safety

Public safety, for the purposes of this analysis, relates to dangerous incidents, motor vehicle accidents, and avalanches potentially involving park visitors and employees. Public safety is evaluated in relation to existing conditions as documented in the *Affected Environment*.

Impacts to public safety at YNP, GTNP, and the Parkway are closely related to changes in winter use activity levels, use of trails by different user groups, and the implementation of safety-oriented policy changes. Changes in activity levels affect the potential for conflict among and between user groups. For example, if participation in a particular activity is expected to decrease through the implementation of an alternative, the potential for incidents among that activity group will be expected to decrease. The use of trails for different activities also increases the potential for incidents or conflicts between user groups. Speeds associated with motorized use inherently decrease reaction time when nonmotorized participants are encountered on the same trail.

The impact levels identified for each alternative are relative to those stated for alternative A. All impacts on public health are defined as short term (see the introduction to *Assumptions and Methods for Evaluating Impacts*).

Table 59. Definition of impacts to public safety.

Impact Category	Definition
Negligible	The impact to public safety is not measurable or perceptible.
Minor	The impact to public safety is measurable or perceptible, and is limited to a relatively small number of winter use visitors at localized areas. Impacts to public safety may be realized through a minor increase or decrease in the potential for visitor conflicts in current accident areas.
Moderate	The impact to public safety is sufficient to cause a permanent change in accident rates at existing low accident locations or create the potential for additional visitor conflicts in areas that currently do not exhibit noticeable visitor conflict trends.
Major	The impact to public safety is substantial either through the elimination of potential hazards or the creation of new areas with a high potential for serious accidents or hazards.

Geothermal Features

Visitor access can cause degradation to geothermal features. Increases or changes in access may increase the degree to which geothermal features are impacted. Geothermal areas near roads or developments are more likely to be impacted than geothermal areas located in the backcountry. YNP monitors and seasonally removes trash from geothermal features, providing an indirect means of measuring the impact of visitor use on these areas. In addition the knowledge of park staff was utilized to describe the current types of damage that are occurring to geothermal features in the parks.

Water Resources

Studies on snowpack and snowmelt chemical analysis are being conducted to determine the effects, if any, of 2-stroke engine emissions on water quality. Until these studies are complete, it may be assumed that emissions and discharge from snowmobiles may directly or indirectly contribute to water pollution, particularly in areas where roads parallel riparian and wetland areas. The closer the road is to water or wetland areas, the higher the risk of water pollution. To assess the potential risk of pollutants entering surface and subsurface waters, road segments, upon which winter motorized use occurs (based upon their proximity to surface waters or wetlands as shown on the U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory maps), are categorized as "high," "medium," or "low" risks for water quality and aquatic resources degradation.

"High" risk segments are within 100 meters of rivers, lakes or other waters for a significant portion (76% to 100%) of the road segment, thereby posing a higher potential or risk of pollutants entering surface and subsurface waters. "Medium" risk segments are within 100 meters of rivers, lakes, other waters, or wetlands for a moderate portion (51% to 75%) of the road segment. "Low" risk segments are within 100 meters of rivers, lakes or other waters less than 50% of the road segment. Assessment of risks is the initial step in assigning an impact level to an action.

Impacts to water and aquatic resources are defined at various levels described in Table 60. Consideration of impacts and their disclosure is a function of risk, intensity, duration, and extent.

Table 60. Definition of impacts to water and aquatic resources.

Impact Category	Definition
Negligible	An action that is a low risk of degrading water quality because of sufficient separation between the action and conveyance routes to the resource, or because the action does not generate impact sources harmful to water resources.
Minor	An action that could represent a low risk of degrading water quality, involving non-toxic or non-point and minor sources of pollution that do not persist in the environment.
Moderate	An action that could represent a moderate risk of degrading water quality by proximity to surface water, involving sources of pollution that are persistent in the environment and may be toxic to aquatic biota, but which are mostly local in extent.
Major	An action that could represent a high risk of degrading water quality by immediate proximity to surface water, involving sources of pollution that are persistent in the environment and may be toxic to aquatic biota beyond the local area.

Wildlife, Including Federally Protected Species and Species of Special Concern

Regulations and policies for management of wildlife underlie the analysis determinations presented in the consequence discussions. A summary of this direction (including legislation and executive orders) is presented in Appendix C.

Methods

The following sources of information were used to assess the level of impact on wildlife:

1) Scientific literature on species' life histories, distributions, habitat selection, and responses to human activities.
2) Site-specific information on wildlife species in the parks, including complete and on-going studies (when available), and the professional judgment of park biologists familiar with the management concerns related to individual species.

The results of this information review are included in its entirety under alternative A; subsequent alternative analyses compare and contrast effects relative to alternative A.

The effects analyses for wildlife is structured according to the types of actions that are addressed programmatically in all alternatives. These are: (1) the effects of groomed roads and trails; (2) the effects of motorized oversnow use of groomed roads and trails; (3) the effects of plowed roads; 4) the effects of motorized use of plowed roads; (5) the effects of nonmotorized use of groomed and designated ungroomed routes; (6) the effects of unregulated backcountry nonmotorized use; and (7) the effects of the presence and use of winter support facilities (i.e., warming huts and campgrounds). Variations in alternatives that mitigate the impacts of these actions are included and reflected in the statements of effects. Additional recommended mitigation is provided at the end of the wildlife analysis for each alternative. Wildlife effects discussions are grouped under the

general headings of *Ungulates, Federally Protected Species,* and *Species of Special Concern.*

In addition to the effects analysis presented in this document, a biological assessment (BA) was prepared as required by Section 7 of the Endangered Species Act to assess the effects of the preferred alternative on federally protected species. Effects in the BA were described as mandated by the USFWS, and include a determination of whether the preferred alternative, including all related actions, may or may not affect each federally protected species. Readers are advised that this type of determination, in which the alternative is treated in its entirety, is different from the effects analysis presented in this EIS. As stated in the preceding paragraph, the level of impact associated with *each* action under each alternative is defined; the impact of the alternative *as a whole* is not defined. Table 61 defines the levels of impact on wildlife in this document.

Table 61. Definition of impacts to wildlife, including federally protected species and species of special concern.

Impact Category	Definition
No Effect	An action that does not affect a species.
No Known Effect	An action that may affect a species elsewhere but for which there are no demonstrated impacts known to occur in the parks.
Adverse Negligible Effect	An action that may affect a population or individuals of a species, but the effect will be so small that it will not be of any measurable or perceptible consequence to the population.
Adverse Minor Effect	An action that may affect a population or individuals of a species, but the effect will be small; if it is measurable, it will be a small and localized consequence to the population.
Adverse Moderate Effect	An action that will affect a population or individuals of a species or a natural physical resource; the effect will be measurable and will have a sufficient consequence to the population but is more localized.
Adverse Major Effect	An action that will noticeably affect a population or individuals of a species or a natural physical resource; the effect will be measurable and will have a substantial and possible permanent consequence to the population.

In GTNP and the Parkway five areas that have been shown to be particularly sensitive to wintering wildlife have been regulated and are closed to use throughout the winter season. The areas are shown on all alternative maps, and are listed below along with short descriptions of the wildlife use. Closure to all winter uses eliminates the potential effects of the actions listed above on wildlife species.

- The Snake River floodplain, from the confluence of the Buffalo Fork (at Moran Junction) downstream to the Menor's Ferry crossing north of the Moose development, provides winter habitat for elk, moose, bison, trumpeter swans, bald eagles, and wolves.
- The Willow Flats area (northwest of the Jackson Lake junctions) including the Second, Third, Pilgrim, Spring, and Christian Creeks drainages south and west of US 89/287, but excluding the Jackson Lake Lodge, provides important habitat for moose.
- The Buffalo River floodplain and the Uhl Hill area east of Moran Junction provides winter habitat for bison and elk and winter prey for wolves.
- Kelly Hill (southeast of Moose Junction) near the Gros Ventre River provides important bison and bighorn sheep winter range.
- Static Peak provides additional bighorn sheep winter range.

In YNP a closure is enforced on McMinn Bench, an important winter range for bighorn sheep.

Natural Soundscape

Analysis Approach for Determining Noise Impact on the Natural Soundscape

Different metrics are presented to assist in evaluating the potential impacts of noise on the natural soundscape. "Audibility" of vehicles (oversnow vehicles, autos, and buses) is an approach that is easily understood and can be used to compare different types of vehicles and different project alternatives. Audibility is expressed in terms of distances to the limits of vehicle audibility, acres of park land affected by audible vehicle traffic, and the percentages of time vehicles are audible in sections of park land. "Sound level" is used to convey the loudness of vehicular sound at different distances from park roads.

To compare the audibility of different vehicle types, the greatest distance that an individual vehicle pass-by can be heard was calculated. Since this distance to the limit of audibility depends upon both the background (ambient) sound level and the rate at which sound drops off with distance, calculations for different background sound conditions and different terrain types were performed.

The following paragraphs first summarize how ambient levels were determined, and then present the measured sound levels of various vehicles. Next, the method of using these data to compute the maximum distances at which the various vehicles are audible is described. Then, the computation of cumulative audibility of vehicles at different distances from the road is presented. Finally, the calculation of average sound levels as a function of distance is described. Appendix J presents more details on these methodologies.

Background Sound Conditions and Terrain Characteristics

As described in Chapter III, *Affected Environment*, sound level measurements were conducted at several locations throughout YNP and GTNP in February and March 2000. These sound level measurements, supplemented by simultaneous audibility logging for portions of the measurement periods, were used to establish the background sound conditions for this analysis.

Based on the logging and observations made during site visits, hours during the day (8 A.M. to 6 P.M.) at each site were selected when intruding sound sources were likely to be present less than 50% of the time. These selected hours became the set of hourly statistical sound level data from which the background sound conditions were derived.

For the purposes of this analysis, two specific background sound level conditions were identified for assessing impacts over the range of conditions: 1) the "average" condition,

which includes the average effects of wind during the day; and 2) the "quiet" condition, which represents times when winds are light or calm.

Also, as described in Chapter III, the analysis assumed that the A-weighted sound level exceeded 90% (the L_{90}) of each hour in which there were no or relatively few intrusions would be the level used in the impact analysis for each alternative. Based on the site characteristics and the measured sound level data, two categories of sites were assumed: 1) sites in mostly open or lightly forested areas ("open"); and 2) sites in moderately forested to heavily forested areas ("forested"). The background sound levels in the open areas were slightly lower than those in the forested areas, the difference being due to the sound of wind in the trees.

The "average" background sound level in the open areas was 20 dBA; in forested areas, it was 22 dBA. The "quiet" background sound level in the open areas was 15 dBA. In the forested areas, the quiet sound level was 18 dBA.

Audibility of a sound depends upon the frequency content (spectrum) of that sound and of the background sound. Sound spectra for each of the background conditions were thus required. Spectra corresponding to the background A-levels cited above were taken from tape recordings of the background sound environment made at each site during the measurement program.

Wheeled and Oversnow Vehicle Sound Levels

Sound level projections start with reference noise emission levels, the maximum pass-by sound level of an individual wheeled or oversnow vehicle at a reference distance, usually 50 feet. Table 62 shows the A-weighted reference pass-by emission levels at 50 feet for the oversnow vehicles for the speeds used in the sound level projections. Table 62 also shows the reference emission levels for the rubber-tired road vehicles (automobiles and buses) used in the analysis (Menge 1998). The audibility and sound propagation models require an analysis by frequency, so the one-third octave frequency band spectral values corresponding to the A-weighted vehicle emission levels were obtained and incorporated in the model.

Table 62. Reference wheeled and oversnow vehicle noise emission levels.

Vehicle Type	Speed (mph)	Emission Level at 50 Feet (dBA)
Snowmobile	40	74
Bombardier snowcoach	30	75
4-track conversion van snowcoach	30	69
Snowplane	28	90
Automobile and van	40	68
Bus	40	76

The rate at which sound drops off with distance by frequency was taken from the FHWA Traffic Noise Model's (TNM's) sound-propagation algorithms, using snow as a ground-cover type. TNM also includes tree zones as an input type, which was used for the moderately forested to heavily forested area analysis. The effect of trees is to reduce propagating sound levels by 5 dB to 10 dB over longer distances. The losses are less for low frequencies than for high frequencies. Most of the terrain throughout the study area is rolling or nearly flat. For practical purposes, the modeling assumed flat terrain.

Audibility Analysis — Single Events

Audibility was computed for each of the wheeled and oversnow vehicle types based on auditory signal detection calculations, which compare the computed vehicle sound levels by frequency to the background sound levels by frequency. The metric of audibility is called d' (d-prime). A threshold for audibility derived from field observations occurs where 10 log d' = 7 dB (Fidell 1994). This threshold was used in this analysis. Appendix M provides more details.

Audibility Analysis — Combined Effects of All Oversnow and Wheeled Vehicles

The next level of analysis combined all of the wheeled and/or oversnow vehicles projected to be on each roadway segment for each study alternative for combined audibility calculations. For Jackson Lake, a single path was assumed, essentially down the middle of the lake in a north-south orientation, even though snowplanes and snowmobiles are free to travel anywhere on the lake surface.

The distance to the limit of audibility for each segment was determined for the "average" and "quiet" background conditions and for the appropriate proportion of open and forested terrain for that segment. Appendix M contains tables of these distances for each alternative. Also determined was the percentage of time any of the oversnow or wheeled vehicles on a given roadway segment would be audible at different distances back. Composite summaries of total area (acreage) of park land affected were computed by multiplying the distance to audibility by the segment length. Appendix M provides more details on these calculations.

The results that will be presented in Chapter IV include the acres of park land (by road segment) where any wheeled or oversnow vehicle noise is audible for each alternative. These results are for both the "average" and "quiet" background conditions and for three categories of audibility: (1) audible any amount of time ("audible at all"); (2) audible for 10% of the time or more; and (3) audible for 50% of the time or more. These categories were chosen as reasonable means of assessing impacts and comparing alternatives.

It is important to note that audibility does not mean the sound levels of the oversnow or wheeled vehicles are necessarily high. Even if a oversnow vehicle would be barely audible, not even to the extent of raising the overall A-weighted sound level, that acreage would be counted.

In the calculations, it was assumed that the number of wheeled and oversnow vehicles would be evenly, but randomly, distributed during the day. In reality, for many of the modeled road segments, there tends to be a concentration of vehicles over certain hours based on the distance a site is from the major points of origin and destination. This concentration applies to, for example, day trips by snowmobile or snowcoach tours to Old Faithful, wheeled vehicles bringing people to the staging areas for these tours, and snowplanes going out onto Jackson Lake for ice fishing. If this concentration were modeled, the probable result would be increased acreage for the "audible at all" category (concentration produces higher levels at any given time), but decreased acreage for the other two categories because there would be more time when few or no vehicles passed by.

Average Sound Level Analysis

To permit an evaluation of the average magnitude of the noise from wheeled and oversnow vehicle traffic, computations of the hourly equivalent or "average" sound level (L_{eq}) over the day were performed. Levels were computed for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain.

These hourly L_{eq} values do not have the background sound level added into them. Also, they cannot be compared against the background levels to assess audibility, because L_{eq} represents a long-term average of both quiet and loud moments.

For example, if only a single snowmobile, with a maximum level of 70 dBA, passed by a site 100 feet from a trail in an entire hour, the L_{eq} for that hour at that site would be about 40 dBA to 45 dBA. If ten 70-dBA snowmobiles passed by instead of one, the L_{eq} would be about 50 dBA to 55 dBA.

The concentration of vehicles during certain periods of the day, discussed above, would result in a modest increase in the hourly L_{eq} during the heavy-use hours, but a much greater reduction in L_{eq} (possibly to zero) for those hours when very few or any vehicles would pass by. Concentration of vehicles does not affect the reported average daylong L_{eq} values.

Cultural Resources

The assessment of impacts to cultural resources followed a three-step process:

1) Determining the area of potential effect of the proposed actions;
2) Identifying the cultural resources within the area of potential effect that are either listed in or eligible for listing in the National Register of Historic Places; and
3) Assessing the extent and type of impacts the proposed actions may have upon cultural resources.

Regulations and policies for cultural resource management underlie the analysis determinations presented in the consequence discussions. A summary of this direction is found in Appendix C.

An impact on a cultural resource occurs if an action has the potential of altering in any way the characteristics that qualify the resource for inclusion in the National Register. If a proposed action diminishes the integrity of such characteristics, it is considered to have an adverse effect. Impacts that may occur subsequent to or at a distance from the location of a proposed action are also potential impacts of the action, and are considered indirect effects.

Potential impacts are based on best professional judgment and have been developed through discussions with staff from the NPS, the Wyoming, Montana, and Idaho State Historic Preservation Offices, the Advisory Council on Historic Preservation, affiliated American Indian tribes, and representatives of other state and local agencies and organizations.

This plan will provide state and local agencies and the public with information on the effects that the alternatives would have on cultural resources. It also describes the ways in which significant effects, if any, would be mitigated.

Visitor Access and Circulation

Changes in how people access park attractions or resources (that is, the modes of transportation they use and the activities they pursue) are evaluated. Potential access changes may occur in alternatives that provide incentive for shifts in park access from one entrance station to another or in alternatives that may potentially divert existing visitors to other areas outside the park units.

In comments on the DEIS, cooperating agencies and others supported the inclusion of use limitations. Specified use limits were not part of the DEIS. At the same time, they expressed concern about how displaced snowmobile use would affect lands adjacent to the parks. The DEIS included no quantitative predictions about use redistribution, although it did discuss the subject qualitatively. In response to these comments, the NPS determined that it needed to provide quantitative scenarios of the resulting use for each alternative. It should be understood that the NPS cannot predict what will happen. However, CEQ regulations (40 CFR §1502.22) allow NEPA processes to be completed despite unavailable data. It allows the construction of reasonably foreseeable impact scenarios upon which to proceed. Through comments on the DEIS, the NPS feels there is sufficient demand through comments on the DEIS to engage in this approach.

A scenario is provided that shows a reasonably foreseeable distribution of current use in each alternative. The scenarios are used for showing impacts on visitor access, and as inputs for modeling or assessing possible impact on, or risks to, other resources such as noise, air quality, and water.

Appendix J provides the calculations for each scenario. The basis for redistributing use is the current average daily use on each road or motorized trail segment. Where this use is not available under an alternative, it is considered to be displaced from that location. Depending on the alternative, a percentage of displaced users are assumed to continue to

snowmobile in the GYA parks, but distributed to other open gateway road segments. From visitor use surveys, it is known that a percentage of all winter users go to various destinations in YNP. These percentages are applied to the existing and displaced (or redistributed) use on the open gateway road segments in each alternative. For alternatives in which no segments are closed to oversnow motorized use, use remains at levels described in current management.

Figures used in the calculations were derived from the following sources: entrance station and visitor use statistics from Visitor Services Offices of Yellowstone and Grand Teton National Park and the Parkway 1992-1999, interior road segments in YNP and GTNP (Borrie et al. 1997; Littlejohn 1996; Duffield et al. 2000). Table 63 provides definitions for evaluating potential impacts by duration and extent.

Table 63. Definition of impacts to visitor access and circulation.

Impact Category	Definition
Negligible	The impact to access is not measurable or perceptible. Trip characteristics or access to desired destinations are not altered through implementation of the alternative action.
Minor	The impact to access is measurable or perceptible, and is limited to a relatively small number of winter use visitors desiring access to a localized area or attraction. However, access to the localized area or attraction can be gained through alternative routes with little disruption of circulation patterns or loss of winter use opportunities.
Moderate	The impact to access is sufficient to cause a shift in circulation patterns and trip making characteristics requiring a change in the provision of visitor services at desired destination areas or the shifting of services to other destination areas within the park units. The change is measurable and perceptible but does not deny visitors access to specific park attractions.
Major	The impact to access is substantial through the elimination of access to specific park attractions. Implementation of the alternative action would cause a loss of access to many current winter use visitors.

Visitor Experience

This assessment is based on visitor surveys of several different groups of respondents. The first group includes data from surveys of winter visitors to the parks. The second group includes surveys that examine the opinions of summer visitors and the local, regional and national populations at large concerning winter use management. The third set of surveys includes information from studies conducted by the states of Montana, Idaho and Wyoming, and Teton County, Wyoming. Two indicators of impact level were used in the analysis. First, the availability of the range of winter visitor opportunities was determined for each alternative. Second, the range of opportunities available under each alternative was compared with the satisfaction, importance and value that the various survey respondents place on that particular experience or opportunity. Where the opinions of different user groups diverge concerning a particular value they are identified in the analysis.

Criteria that are used to gage visitor satisfaction in each alternative are:

- Opportunities for viewing wildlife;
- Opportunities for viewing scenery;
- The quality of the groomed or ungroomed snow surface;
- Safety (the safe behavior of others);
- Access to winter activities and experience;
- Opportunities for quiet and solitude; and
- Clean air.

These indicators of visitor satisfaction were derived from eight primary sources: Littlejohn (1996); Friemund (1996); Borrie and Friemund (1997); Borrie et al. (1999), Davenport (1999); and Duffield et al. (2000a. 2000b, and 2000c). Other winter use surveys and assessments from Teton County, Wyoming and the states of Wyoming, Montana and Idaho, and YNP and GTNP were used to validate the criteria. Please refer to the *Visitor Experience,* Chapter III section for more detailed discussion of the survey data used in this analysis. Table 64 includes definitions for impacts to visitor experience.

Table 64. Definition of impacts to visitor experience.

Impact Category	Definition
Negligible	Little noticeable change in visitor experience.
Minor	Changes desired experiences but without appreciably limiting or enhancing critical characteristics of the experience.
Moderate	Changes critical characteristics of the desired experience or reduces or increases the number of participants.
Major	Eliminates, detracts from or greatly enhances multiple critical characteristics of the desired experience or greatly reduces or increases participation.
Neutral	An action that will create no change in the defined indicators of visitor satisfaction or quality of park experience.

Regulations and policies for management of visitor activities underlie the analysis determinations presented in the consequence discussions. A summary of this direction is presented in Appendix C.

EFFECTS COMMON TO ALL ALTERNATIVES

Socioeconomics

Actions that affect park visitation levels can impact socioeconomics. If visitor use capacities different than current use levels are enforced by reservations, permits, or differential fees, there may be significant impacts on socioeconomics. At this time, future visitor use capacity changes, if any, are unknown.

Wildlife

Effects of oversnow motorized sound. Animals may exhibit physiological and behavioral responses to human-caused noise. Because physiological responses are difficult to measure in the wild, Moberg (1987) recommended using outcome measures

such as reproductive success and survivorship as indicators of noise-induced stress in free-ranging animals. Most effects of sound are mild enough that they are never detectable as changes in population size or growth (Bowles 1995). This fact demonstrates to the ability of animals to tolerate unnatural noise. Ungulates in particular are especially adaptable to predictable, repeated noise and, if good hiding cover is available, they may show little change in habitat use or home range size (Eckstein et al. 1979; Edge et al. 1985). In general most wildlife species rarely respond with uncontrolled, panic behaviors to noise that is not associated with danger (Bowles 1995). Instead, most responses are subtle and short term.

It is the association of sound with danger that apparently dictates the degree of response. Studies have shown that the range at which animals avoided traffic was about the range at which they could detect traffic noise (Dorrance et al. 1975; Singer and Beattie 1986; Gese et al. 1989). This finding suggests that traffic noise was meaningful through its association with human activity. Repeated exposure without harassment increases tolerance, thus decreasing response. Of course, at some point, there may be a trade-off between the energy saving value of habituation and decreased wariness to potential danger, such as high levels of traffic.

An analysis of the effects of sound on wildlife is implicit in the assessment of motorized use for each alternative. It can be inferred that as the level, location, and type of motorized use changes, so will the associated effects of motorized sound. An analysis of how the natural soundscape is impacted by alternative is included in this chapter.

Natural Soundscape

Table 65 presents the computed distances to the limits of audibility of a single pass-by of each vehicle type in the open and forested terrain conditions for both the “average” and “quiet” background conditions.

The quieted oversnow vehicles, which were modeled in alternatives B and D, are shown here for completeness. Likewise, a distinction is made for snowplanes, showing the existing average pass-by level and the level if all snowplanes were held to the current 86 dB regulated level. Except for those distinctions, the results shown in Table 65 do not differ among the alternatives because they are associated with single pass-by events. A vehicle type of “group of 4 snowmobiles” is included because snowmobiles tend to travel in groups, which is not so for the other vehicle types.

Because the distances to audibility limits are based on the unique frequency characteristics of the sound sources, the background environments and the human auditory system, comparisons of the A-weighted sound levels alone will not lead to an understanding of differences. For example, the Bombardier snowcoach can be heard at greater distances than the snowplane, which exhibits significantly higher A-weighted sound levels. Most of the sound energy from the snowplane at 50 feet is in the mid-and high frequencies, which become significantly reduced over long distances, whereas most

of the sound energy from the Bombardier snowcoach is in the lower frequencies, which are much less attenuated by distance.

Table 65. Distances to limits of audibility for individual vehicle pass-bys in open and forested terrain and in average and quiet background conditions.

Vehicle Type	Noise Emission Condition	Maximum 50 ft Pass-by Level (dBA)	Distance to Limit of Audibility (feet)			
			Open Terrain		Forested Terrain	
			Average Background	Quiet Background	Average Background	Quiet Background
Automobile	Existing	68	2,180	2,330	1,130	1,200
Bus	Existing	76	5,520	6,090	2,620	2,860
Snowmobile	Existing	74	3,860	4,120	1,990	2,230
Group of 4 snowmobiles	Existing	74 each	7,000	7,510	3,340	3,790
Bombardier Snowcoach	Existing	75	8,560	9,690	3,860	4,230
4-Track Conversion Van SC	Existing	69	2,030	2,200	1,110	1,210
Snowplane	Existing	90	6,680	7,340	3,010	3,200
Snowmobile	Quieted - 70	70	2,690	2,860	1,450	1,620
Group of 4 snowmobiles	Quieted - 70	70 each	4,730	5,060	2,370	2,670
Bombardier Snowcoach	Quieted - 70	70	5,440	6,160	2,540	2,780
4-Track Conversion Van SC	Quieted - 70	69	2,030	2,200	1,110	1,210
Snowplane	Regulated 86	86	4,550	4,950	2,190	2,320
Snowmobile	Quieted - 60	60	2,150	2,260	1,160	1,290
Group of 4 snowmobiles	Quieted - 60	60 each	3,790	3,990	1,920	2,150
Bombardier Snowcoach	Quieted - 60	60	3,840	4,300	1,840	1,990
4-Track Conversion Van SC	Quieted - 60	60	1,240	1,340	720	790

These distances were used to compute impacted acreage by road segment for three categories of audibility: 1) audible any amount of time (“audible at all”); 2) audible for 10% of the time or more; and 3) audible for 50% of the time or more. See Appendix M for details on the approach: tables are presented for each alternative in the discussions of effects by alternative.

In those tables, the road segment from Moran Junction to the South Entrance of GTNP contributes the greatest to the total acreage values for all three audibility categories. For each alternative, amounts that remain almost constant for all of the alternatives. This plowed road, which is mostly along open terrain, carries a great deal of wheeled-vehicle traffic either passing through the park on US 26 or destined for Jackson Hole Airport or park offices in Moose and Beaver Creek. This road segment also carries a smaller amount of alternative-specific traffic destined for Flagg Ranch, Colter Bay, Teton Park Road and ski trailheads in GTNP.

Another major contributor to the “audible at all” acreage and, to a lesser extent, “audible 10% or more” is the plowed road segment from Mammoth to the YNP Northeast

Entrance, by far the longest of the modeled segments. Its contribution to the acreage amounts also remains virtually unchanged across all of the alternatives.

Visitor Experience

Visitors who have physical disabilities would have improved access under all alternatives as winter access action plans are implemented and barriers to facilities and programs are removed. All facilities, such as warming huts, mass transit or snowmobile staging areas and restrooms, proposed for construction or reconstruction, would comply with all federal and NPS accessibility requirements.

MITIGATION COMMON TO ALL ALTERNATIVES

Water Resources Mitigation

- Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation.
- New sanitary facilities would be constructed in locations using advanced technologies that would protect water resources.
- Separate winter-motorized trails from drainages to mitigate the routing of snowpack contaminants into surface water.
- Any new or reconstructed winter use sanitary facilities would be constructed in locations and with advanced technologies that would protect water resources.
- A focused monitoring program would reduce the uncertainty of impacts from oversnow vehicles, and if necessary indicate best management practices that might be implemented.

Wildlife, Including Federally Protected Species and Species of Special Concern

- All area closures to protect sensitive resources would be enforced through regular patrols by NPS personnel.
- Monitoring of eagle populations to identify and protect nests would continue. The park would continue to support the objectives of the Greater Yellowstone Bald Eagle Management Plan.
- Monitoring of wolf populations would continue.
- Lynx surveys would occur to document the distribution and abundance of lynx in the parks, and the parks will abide by the recommendations of the Lynx Conservation Assessment Strategy. The presence of other carnivores will be documented.
- Monitoring of grizzly bear populations would continue in accordance with the Interagency Grizzly Bear Management Guidelines and the parks' bear management plans.
- Monitoring and protection of trumpeter swan habitats and nests would continue, including the closure of nest sites, when warranted, to public access from February 1 to September 15.
- Monitoring of potential or known winter use conflicts would result in area closures if necessary to protect wildlife habitat.

Cultural Resources

- Should the discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony occur during construction, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed.
- Trails and trailheads would be sited to avoid adversely impacting known cultural resources, including potential cultural landscapes. In addition the use of natural materials and colors

for all permanent signs erected would allow the signs to blend into their surroundings.

IMPACTS OF IMPLEMENTING ALTERNATIVE A — NO ACTION

Effects on the Socioeconomic Environment

Regional Economy. In 1996, the states of Montana, Idaho, and Wyoming had a combined total economic output of about $109.5 billion and total full- and part-time employment of about 1.5 million jobs. The much smaller five-county GYA in 1996 had a total economic output of $5.7 billion and total employment of 97,000 jobs.

The no action alternative would not impose any management changes on winter use in the parks that would restrict or change winter visitation from its current level and trends.

Minority and Low-Income Populations. Currently, about 11.9% of winter visitors to the GYA report annual household incomes below $25,000. This figure is substantially higher for winter recreationists who live within the GYA (25.1%), and lower for visitors from outside the three-state area (5.2%). The racial composition of winter visitors is very homogeneous with 99% of respondents classifying themselves as white.

Under the no action alternative the current distribution of income and racial composition could be expected to remain unchanged.

Social Values. The general public has strongly held and divergent values and opinions on public policy issues concerning winter management of YNP and GTNP. Respondents to the 1999 winter visitor survey reported overall support for continued mechanized winter access to YNP. About 67% of respondents to the survey either agreed or strongly agreed with the statement "visitors should have the opportunity to have mechanized winter access to YNP." Over 61% of respondents also agreed with the statement "I am concerned about the possible disturbance of YNP wildlife in the winter."

Continuation of the current policies under the no action alternative would be in concert with the majority support by current winter users for continued winter mechanized access. On the other hand, as discussed in the chapter on the *Affected Environment,* the existing winter access policy is not preferred by the public in the region or the nation.

Nonmarket Values. Impacts on benefits that visitors and others derive from YNP and the GYA would result from any changes in park visitation levels, and the quality and extent of changes in park management. The average nonmarket willingness to pay for a winter trip to the national parks within the GYA is $91 per person.

Under the no action alternative, there would be no expected changes in park visitation levels resulting from any NPS management changes. Therefore, no management-related change in aggregate nonmarket values would be expected to occur.

Conclusion

The no action alternative would continue current policies in place within the GYA parks. No policy-related impacts on socioeconomics would result.

Effects on Air Quality and Public Health

Under alternative A winter use activities would continue at a level similar to current conditions. As noted in Chapter III, a number of studies have been conducted in recent years to characterize air quality on high snowmobile use days. Also, short-term air quality analyses were performed by means of atmospheric dispersion modeling for carbon monoxide (CO) and particulate matter (PM_{10}) to assess the relative impacts of the winter use alternatives, including alternative A, on ambient air quality in the GYA. Table 13, Table 14, and Table 15 summarize the results of CO modeling for six locations in the three parks for alternative A. Table 66 and Table 67 show the predicted maximum 1-hour average CO concentrations and the calculated maximum 8-hour average CO concentrations, respectively. The percent contribution of each vehicle type to the maximum CO concentrations also is provided in Table 68 for the six locations. As noted in the *Methodologies* section, the maximum concentrations are based on a peak morning hour of a high use winter day, which typically occurs during President's Day weekend in February.

Table 66. Maximum 1-hour average CO concentrations for alternative A.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	29.20	32.20	N.A.
West Entrance to Madison Roadway	11.80	14.80	
Old Faithful Staging Area	1.29	4.29	
Flagg Ranch Staging Area	1.72	4.72	
Flagg Ranch to Colter Bay Roadway	1.10	4.10	
Mammoth to NE Entrance Roadway	0.30	3.30	

Table 67. Maximum 8-hour average CO concentrations for alternative A.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	13.74**	15.15**	N.A.
West Entrance to Madison Roadway	5.55**	6.96**	
Old Faithful Staging Area	0.21	1.62	
Flagg Ranch Staging Area	0.29	1.69	
Flagg Ranch to Colter Bay Roadway	0.52**	1.93**	
Mammoth to NE Entrance Roadway	0.14**	1.55**	

** Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

As noted in Table 66 CO levels are highest at the West Entrance and along the West Entrance to Madison road, where relatively large numbers of snowmobiles operate in relatively small geographic areas. Although the maximum West Entrance 1-hour average concentration is larger than the Montana 1-hour ambient air quality standard of 23.0 ppm and the 8-hour average CO concentration is larger than the federal ambient air quality standards of 9.0 ppm, this does not indicate that violations of the standards are predicted. Violations of the standards are based on the second highest CO concentration measured, while the model provides only the highest value. Although there are relatively large numbers of snowmobiles at the two staging areas, modeled CO concentrations are relatively low since the machines are spread out over a wider area. Finally, the Mammoth to Northeast Entrance roadway exhibits the lowest CO concentrations. Coincidentally, no snowmobiles or snowcoaches operate along this roadway.

Table 68. Vehicle contribution to CO concentrations for alternative A.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	97.9	2.0	0	0	0.1	0	0
West Entrance to Madison Roadway	98.6	1.4	0	0	0	0	0
Old Faithful Staging Area	98.1	1.9	0	0	0.1	0	0
Flagg Ranch Staging Area	72.2	1.2	7.9	15.8	0.1	0.1	2.7
Flagg Ranch to Colter Bay Roadway	49.8	0	12.8	31.8	0.3	0.2	5.1
Mammoth to NE Entrance Roadway	0	0	26.5	66.9	0.5	0	6.1

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Table 69 and Table 70 provide corresponding model results for PM_{10} for the same locations and conditions as those for CO. Like CO levels, predicted PM_{10} concentrations are highest at the West Entrance. However, violations of the state and federal ambient air quality standards of 150µg/m3 are not predicted by the 24-hour maximum predicted concentrations.

Table 69. Maximum 24-hour average PM_{10} concentrations for alternative A.

Location	24-hr Maximum Concentration (w/o Background) (µg/m3)	24-hr Maximum Concentration (w/Background) (µg/m3)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	45.19**	68.19	N.A.
West Entrance to Madison Roadway	10.74**	33.74	
Old Faithful Staging Area	0.64	5.64	
Flagg Ranch Staging Area	0.63	5.63	
Flagg Ranch to Colter Bay Roadway	0.95**	5.95	
Mammoth to NE Entrance Roadway	0.32**	5.32	

** Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 70. Vehicle contribution to PM_{10} concentrations for alternative A.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	99.3	0.2	0	0	0.5	0	0
West Entrance to Madison Roadway	97.6	1.1	0	0	1.3	0	0
Old Faithful Staging Area	99.8	0	0	0	0.2	0	0
Flagg Ranch Staging Area	99.3	0	0	0	0.4	0.3	0
Flagg Ranch to Colter Bay Roadway	45.4	0	10.2	20.9	13.1	7.1	3.4
Mammoth to NE Entrance Roadway	0	0	22.5	46.6	26.7	0	4.2

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Visibility

The visibility assessment indicates that under this alternative, vehicular emissions would cause localized, perceptible, visibility impairment near the West Entrance and in the area around Old Faithful and Flagg Ranch. The emissions along heavily used roadway segments would also lead to localized, perceptible, visibility impairment under certain viewing conditions.

Conclusion

Based on previous studies and the results of air dispersion modeling conducted for this analysis, short-term, adverse impacts at the West Entrance would continue at times, during high winter use days. In YNP the effects of wintertime wheeled-vehicle use on air quality would continue to be negligible due to the limited number of automobiles and buses operating in the park during the wintertime. Under this alternative, YNP would continue to use bio-based fuels and lubricants in the park. Since the use of these products produces fewer emissions than other types of fuels and lubricants, a minor reduction in impacts to air quality and public health would be expected.

Effects on Public Safety

Current public safety conditions for visitors and employees in all three park units are identified in the Affected Environment section of this document. Under the no action alternative motor vehicle accident rates (both snowmobile and wheeled) would continue to increase as visitation in the three park areas increases. Accidents on the Continental Divide Snowmobile Trail (CDST) would continue to occur, although infrequently (1 occurred in 1999). Because of the shared automobile/snowmobile travel corridor, safety on this route would remain a concern. The poor condition of some groomed routes would also continue to be a safety concern, particularly on the heavily used section from the West Entrance to Madison Junction and south to Old Faithful.

Avalanche control activities would continue on YNP's East Entrance road, at the Talus Slope and Washburn Hot Springs (spring only) and in GTNP.

Information on snowmobile safety would continue to be provided by ISSA; however, the average first-time visitor would have limited access to snowmobile safety information in the parks.

Conclusion

Alternative A would result in minor adverse impacts to visitor safety along the road from West Yellowstone to Old Faithful, and the CDST, and negligible adverse impacts on less heavily traveled routes. These impacts would directly affect employees and visitors.

Safety concerns for the 3% of winter visitors who utilize the East Entrance will be minor to moderate and adverse. For employees who conduct avalanche control on Sylvan Pass (and other areas) impacts will continue to be minor to moderate and adverse.

Effects on Geothermal Features

Adverse impacts can occur to geothermal features when visitors have unregulated access to geothermal basins. Park visitors can alter or damage geothermal resources by traveling off trail or throwing objects into features. Under alternative A, minor adverse impacts to geothermal resources in both front country and backcountry areas would continue. Some actions, such as throwing objects into the features that block the flow of water, would have major adverse impacts on individual resources. Because of the length of time it takes for this sensitive resource to recover, most impacts would be long term. Currently park personnel educate visitors and mark trails to mitigate adverse impacts on geothermal resources.

The 1990 plan approved the construction of a warming hut at Norris Geyser Basin. The addition of a warming hut would increase winter visitor use in this geothermal basin. Increased visitation would have direct minor adverse effects on geothermal features.

Conclusion

Minor adverse long-term impacts to geothermal features located along groomed roads, around destination areas, and in the backcountry would continue. Degradation to thermal

features located in the Norris Geyser Basin would increase slightly when the warming hut is built.

Effects on Water and Aquatic Resources

Pollutants that are emitted into the air are deposited on the ground or in the snowpack where they either volatilize, percolate into soil materials, or remain stored in snow. Pollutants that persistent in snowpacks or in soil materials can be washed into drainages with snowmelt, or move through the soil into nearby surface water sources, or into groundwater storage over time. Due to geology and topography, the most likely potential pathway for pollutants in the three park units is from snowpack into surface water with snowmelt, or into shallow groundwater reservoirs that enter surface drainages during late summer and early fall.[31] Pollutants present in surface waters are available for uptake by aquatic resources such as vegetation, fish, amphibians, or others who ingest the affected water. Pollutants that persist over time in the environment can be washed beyond the source of impact, eventually to settle in sediments or other traps, or they can be trapped fairly close to the source in wetland vegetation, bottom sediments, or by instream structures (such as dams and wiers).

The following assessment focuses on sources of pollution, and potential pollutants, relating to winter use – combustion products from motorized vehicles (see air resources) – and their impacts on 1) water quality, and 2) water dependent or aquatic resources. The discussion frames potential effects while the conclusion expresses a final analysis of impact on the three park units.

Water Quality

Many different chemical compounds enter the environment from snowmobile emissions but benzene, toluene, ethylbenzene, and xylenes (collectively known as BTEX); methyl tertiary butyl ether (MTBE); and polycyclic aromatic hydrocarbons (PAHs) are widely recognized as the most toxic of the organic compounds. At least two inorganic compounds of potential concern, sulfate and ammonium, are also found in snowmobile emissions (Hagemann and VanMouwerik 1999).

Information is available on issues related to emissions from personal watercraft (PWC) that have 2-stroke engines and use fuel mixtures similar to those used in most snowmobiles. CO and PM emissions from snowmobiles would be different from those produced by PWC because of the colder operating temperatures and differences in the exhaust systems. Reports by VanMouwerik and Hagemann (1999) and Hagemann and VanMouwerik (1999) are the primary source of the following information.

[31] Some people who commented on the draft EIS pointed out that the discussions of air and water seemed to be confused. These sections are rewritten in the Final EIS. NPS wishes to make clear that there is a strong relationship between airborne pollutants and water quality. A number of monitoring sites exist in the GYA and in many places throughout the United States to monitor acid deposition on the ground from ambient air pollution. The strict protocol for locating such sites in snow-dominated climates includes avoiding areas used by snowmobiles or other motorized vehicles.

Studies on emissions from PWC indicate that MTBE and PAHs are the two contaminants most likely to degrade water quality from snowmobile emissions. These contaminants are more likely than others to be found in water primarily due to their persistence in the environment.

The contamination of lakes and reservoirs with MTBE and PAHs has been documented where 2-stroke PWC and outboard motors are used (Metropolitan Water District of Southern California 1998; Reuter et al. 1998; Mastran et al. 1994; Oris et al. 1998). Recreational use of these watercraft has been identified as a primary cause of this contamination. Because water quality degradation has been documented in association with 2-stroke motor usage, it follows that water quality adjacent to areas of high snowmobile use also could be degraded by MTBE and PAH.

It is not known whether or how much fuel used by oversnow vehicles in GTNP and YNP has MTBE additives, however, MTBEs are not currently perceived to be an issue for the parks. MTBEs are not used in fuels sold in Montana (Haines, pers. com., 2000). Wyoming DEQ has no knowledge regarding whether or not MTBE is used in fuels within the State of Wyoming (Potter, pers. com., 2000), however if it is, it would probably be the result of acquiring fuels from refineries in areas where it is used, such as Colorado. Some fuels in Idaho, particularly those obtained from refineries near Salt Lake City, Utah do contain MTBEs; however, EPA has proposed a rulemaking to require the nationwide elimination of MTBE as a fuel additive by the year 2003 (Viswanathan, pers. com., 2000).

Deposition of airborne PAHs onto the ground is a commonly accepted phenomenon, and deposition of PAHs in areas of high snowmobile use is expected. PAHs may also be imparted to snowpack from the injection of tailpipe emissions into deep snow. Losses of PAHs from the snowpack are minimal since degradation processes such as photo-oxidation and volatilization do not occur or are severely impeded (Boom and Marsalek 1988). Studies have measured PAHs in snow from nearby automobile pollution and other point sources (Ettala et al. 1986; Viskari et al. 1997; Gjessing et al. 1984). PAHs from nearby automobile pollution have also been found in surface water (Gjessing et al. 1984). In the St. Lawrence River in Canada, springtime concentrations of PAHs were “most likely caused by snowmelt” from nearby urban, rural, and industrial areas (Pham et al. 1993). Atmospheric PAHs deposited onto snow also were found in a karst groundwater system during and after snowmelt (Simmleit and Herrmann 1986). The PAHs documented in these studies are found in snowmobile emissions.

PAH molecules preferentially bind to organic matter in soil. One study found “an essential part of the PAHs” in snowmelt drainage off of a highway to be retained in the soil surface layer (Gjessing et al. 1984). However, the amount of PAH-contaminated meltwater that will pass over soil is difficult to predict. Some deposition will occur directly onto snow-covered bodies of water. PAH-contaminated soil particles could also be carried with runoff meltwater into nearby water bodies whereby PAHs could

contaminate water bodies by transferring from the soil particles to the water or by accumulating as sediment. Some expect the possible effects of PAH-contaminated sediments to be a more serious, but currently less understood, risk to aquatic life than PAH-contaminated water. Finally, PAHs could also be transported to surface water bodies via overland flow during a rain-on-snow event.

BTEX are quite volatile and do not tend to bind to soil or sediment particles (Irwin et al. 1998). Volatilization rates from snow are not reported in the literature but are expected to be similar to those from water and soil surfaces that vary widely, ranging from less than one minute to a few weeks. Most values reported fall within the range of a few hours to a few days (Irwin et al. 1998). Given this, BTEX compounds are expected to mostly evaporate before the spring melt arrives. However, it may also be possible that BTEX emitted onto the snow from one snowmobile could become packed into the snow by snowmobiles following immediately behind it, in effect trapping these compounds in the snowpack until the spring melt. If this were the case, the amount of BTEX entering an adjacent receiving water will be determined largely by volatilization processes during the spring melt and the time and pathway taken to reach the water. This needs further study. Where snowmobiles are operated directly over frozen bodies of water, the chances of BTEX and other snowmobile contaminants entering the water are greater.

Sulfate in the snowpack associated with snowmobile use would be mobilized with the onset of snowmelt (Ingersoll 1999; Ingersoll et al. 1997). Once sulfate reaches groundwater or surface water, acidification is possible in alpine areas where buffering potential is low because of thin soils and exposed rock (Corn and Vertucci 1992). Pulses of acidity have been observed during spring snowmelt in lakes in the Rocky Mountains (Corn and Vertucci 1992) and in southern Norway (Hagen and Langeland 1973). Water bodies in the Rocky Mountains are thought to be influenced by point sources of atmospheric pollution (Corn and Vertucci 1992; Ingersoll et al. 1997). Nearby lakes on the Bridger-Teton and Shoshone National Forests, for example, are the most highly susceptible lakes in the nation to acidification.

Aquatic Resources

According to EPA's Office of Mobile Sources, about 30% of the U.S. gasoline supply currently contains oxygenates such as MTBE to improve air quality. These oxygenates enhance octane level, increase burning efficiency, and reduce the emission of atmospheric pollutants. MTBE is a suspected carcinogen (California EPA 1999b). There is little known about the risk to aquatic organisms from MTBE, however one of the most thorough studies to date found that there is little toxicity of MTBE to aquatic organisms (Johnson 1998). The study found that adverse effects on rainbow trout are not expected until concentrations of MTBE in the water column reach 4,600 to 4,700 µg/L. These levels are much greater than the human health standards for MTBE in drinking water supplies. Green algae have the lowest tolerance to MTBE but, according to this study,

the results "indicate that there is low potential for adverse ecological effects from levels of MTBE currently in surface waters."

These studies indicate that the emission of MTBE from motor vehicles and incidental spillage have the potential to contaminate water. This contamination is most acute in lakes from the use of PWC where it is at levels that could pose a risk to human health. However, because no sampling has been conducted in the areas of snowmobile use, there is no evidence to conclude for certain that MTBE is present or, if present, if it is in concentrations that would pose a risk to humans and aquatic organisms that consume or contact water. The presence of MTBE and its potential risk in areas of snowmobile use can only be determined through snow- and water-sampling studies.

PAHs (polycyclic aromatic hydrocarbons), which are found in snowmobile emissions (White and Carroll 1998) are known carcinogens and are toxic to aquatic life. PAH concentrations dangerous to human health are very low. The lowest water quality standards for individual carcinogenic PAHs for the consumption of fish from a PAH-contaminated water body is 49 ng/L (parts per trillion), and for the consumption of both fish and drinking water it is even lower at 4.4 ng/L (U.S. EPA 1998b).

PAHs have also been found to be toxic to aquatic life at very low concentrations due to their phototoxic effects (Oris et al. 1998). PAH concentrations of 5-70 ng/L were toxic to aquatic life, and calculated no-observed-effect-concentrations (NOEC) for PAHs were only 3 ng/L, 7 ng/L, and 9 ng/L for zooplankton reproduction, zooplankton survival, and fish growth, respectively (Oris et al. 1998). Another recent study, based on toxicity tests, suggests a water quality standard for total PAHs of only 10 ng/L. This includes a safety factor of about 100 times (Heintz et al. 1999). Levels of PAHs in excess of human health standards and levels that could harm aquatic life have been found in lakes and reservoirs where 2-stroke engines are used (VanMouwerik and Hagemann 1999).

Adams (1975), found hydrocarbons in water and fish tissue as a result of snowmobile use on a frozen pond surface in Maine. Though PAHs were not specifically measured, it is quite possible they were part of the hydrocarbons found. Hydrocarbon concentrations before and after the winter snowmobiling season increased from non-detect to 10 parts per million ppm in water, and from non-detect to 1 ppm in fish tissue. These increases were attributed to snowmobile emissions.

Referenced studies show that the emissions of PAHs from motorboats can contaminate water and that PAHs from motor vehicles can contaminate snow. The PAHs from motorboat pollution have been found at levels that pose a risk to aquatic life and human health. However, because no sampling for PAHs has been conducted in the areas of snowmobile use, it is not known whether they are present or, if present, if they are in concentrations that would pose a risk to humans and aquatic organisms that consume or contact water. Snow and water sampling studies are needed to determine the presence of PAHs and their potential risk in areas of snowmobile use.

BTEX (benzene, toluene, ethylbenzene, and xylenes) are much less persistent and thought to be less of a water quality concern than PAHs, however preliminary and extremely limited sampling in YNP found low levels of toluene in snowmelt waters (Ingersoll 199). Additional monitoring and analyses are needed to verify those findings. BTEX was also detected in the waters of Lake Tahoe, California; however, concentrations were over 1,000 times lower than aquatic life protection levels, even during periods of high motorboat (including PWC) activity (Allen et al. 1998).

No water sampling for sulfate has been conducted in the areas of snowmobile use; therefore, it is not known if acidification is occurring. The presence of sulfate or acidified waters and the potential for aquatic risk in areas of snowmobile use can only be determined through snow- and water-sampling studies. During snowmelt intervals, the rapid decreases in pH may pose a risk to amphibian embryos in breeding habitats in the Rocky Mountains (Corn and Vertucci 1992).

Ammonium has also been found in snowpack in association with snowmobile use (Ingersoll et al. 1997). In snow, it has been found to remain unchanged as ammonium (USGS, Campbell, pers. com., 1999). It is thought to dissolve into meltwater where it remains intact until it passes over soil or enters an oxygenated water body; at this point it can be used by terrestrial flora or be converted to nitrate in soil or in the receiving water. This could contribute to acidification, a decrease in dissolved oxygen, and eutrophication of receiving waters (USGS, Campbell and Mueller, pers. com., 1999).

The potential effects summarized from the literature, above, are circumstantial, and point to concerns about winter use. Specific to YNP, Ingersoll (1999) and Ingersoll et al. (1997) found that concentrations of ammonium, sulfate, benzene, and toluene were positively correlated with oversnow traffic in YNP. Where more snowmobile traffic occurred near West Yellowstone, and Old Faithful, higher concentrations of the pollutants were detected. At the lower-traffic locations near Lewis Lake Divide and Sylvan Lake, lower concentrations were found. At the higher snowmobile-use locations, in-road samples were substantially more concentrated than off-road samples. Concentrations of ammonium and sulfate at the sites in the snowpacked roadways between West Yellowstone and Old Faithful were greater than those observed at any of the 50 to 60 other snowpack-sampling sites in the Rocky Mountain region. Results indicate that snowmobile use along the routes originating at the South and East Entrances may not be substantially affecting atmospheric deposition of ammonium, sulfate, and hydrocarbons relating to gasoline combustion. Sample concentrations in snow collected a distance of 50 meters or more off-road were similar to many lower, background levels around YNP where minimal snowmobile use (if any) occurs.

Ingersoll (1999) concludes, from the analysis of five of the six snow sampling sites, that elevated emission levels in snow along highway corridors generally are dispersed into surrounding watersheds at concentrations below levels likely to threaten human or ecosystem health. Localized, episodic acidification of aquatic ecosystems in these high

snowmobile traffic areas may be possible but verification will require more detailed chemical analyses.

Given the possibility of impacts, it is appropriate as a guide to future monitoring to assess risks. The methods section for water and aquatic resources explains the risk analysis. Risk is predicated on pollutants sources (emissions), types of pollutants (toxicity and persistence), amounts of pollutants, and proximity of the source to water. Sources include emissions from oversnow vehicles and toxic and persistent pollutants (see Air Quality methods and alternative analyses). Quantities of pollution are indexed to the number of oversnow vehicle miles traveled along a segment, and segments are ranked according to their proximity to surface water (and wetlands).

For the existing condition, the relative risks are conveyed in Table 71.

Five road segments totaling about 22% of the current oversnow route miles in YNP, GTNP, and the Parkway (Madison to Norris, Canyon Village to Fishing Bridge, Madison to Old Faithful, Grassy Lake Road, and Colter Bay to Moran Junction) are defined as a "high" risk because more than 76% of each road segment is within 100 meters of rivers, lakes, or other waters, thereby posing a higher potential or risk of pollutants entering surface and subsurface waters.

Table 71[32]. Relative risks considering current oversnow motorized use.

Road Segment	Risk ± Rating	Impact: Daily Vehicle Miles Traveled Along the Segment*	
		SM	SC
Mammoth to Northeast Entrance	Medium	0	0
Mammoth to Norris	Medium	641	69
West Entrance to Madison	Medium	7759	127
Madison to Norris	High	3458	73
Norris to Canyon Village	Low	2214	47
Canyon Village to Fishing Bridge	High	2370	50
Fishing Bridge to East Entrance	Medium	983	0
Fishing Bridge to West Thumb	Medium	2627	55
Madison to Old Faithful	High	7818	165
Old Faithful to West Thumb	Medium	3560	73
West Thumb to Flagg Ranch	Medium	4219	103
Grassy Lake Road	High	184	0
Flagg Ranch to Colter Bay	Low	379	0
Colter Bay to Moran Junction	High	248	0
Moran Junction to East Entrance	Medium	49	0
Moran Junction to South Entrance	Low	0	0
Teton Park Road	Low	156	0
Moose-Wilson Road	Low	6	0
Antelope Flats Snowmobile Route	Low	0	0

Seven road segments totaling about 32% of the current oversnow routes (Mammoth to Norris, West Entrance to Madison, Fishing Bridge to East Entrance, Fishing Bridge to West Thumb, Old Faithful to West Thumb, West Thumb to Flagg Ranch, and Moran Junction to East Entrance) are defined as a "medium" risk because 51% to 75% of each road segment is within 100 meters of surface water or wetlands.

Four road segments totaling about 7% of the current oversnow routes (Norris to Canyon, Flagg Ranch to Colter Bay, Teton Park Road, and Moose-Wilson Road) are defined as posing a "low" risk because less than 50% of each road segment is within 100 meters of surface water or wetlands.

[32] *SM = Snowmobile, SC = Snowcoach; Vehicle-miles derived from visitor use scenarios shown in Appendix J. The source of pollutants is emissions from snowmobiles, which produce (conservatively) 10 times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce less emissions then single snowmobiles.
±High = within 100 meters of rivers, lakes, or other waters for a significant portion (76% to 100%) of the road segment; Medium = within 100 meters of rivers, lakes, other waters, or wetlands for a moderate portion (51% to 75%) of the road segment; and Low= risk segments are within 100 meters of rivers, lakes, or other waters less than 50% of the road segment.

Three road segments (Mammoth to Northeast, Moran Junction to South Entrance, and Antelope Flats Snowmobile Route) currently have no snowmobile traffic and therefore have no impacts from snowmobile emissions.

Based on the literature summarized above, the use of snowmobiles and snowplanes directly on the surface of Jackson Lake is likely causing the direct deposition of hydrocarbons, MTBEs, and PAHs into lake water with ice and snowmelt. This has the potential for a moderate to high adverse impact, as defined, although the effects of use to date have not been measured.

Conclusion

Deposition into snowpack would continue to occur from 2-stroke engine emissions along groomed park roads in YNP and GTNP. The effect of this deposition on water quality is undetermined but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. Elevated emission levels in snow along highway corridors generally are dispersed into surrounding watersheds at concentrations below levels likely to threaten human or ecosystem health. Localized, episodic acidification of aquatic ecosystems in these high snowmobile traffic areas may be possible but verification will require more detailed chemical analyses.

Accumulations of pollutants in aquatic systems may have as yet unmeasured adverse impacts on wetlands and aquatic resources downstream from high-risk road segments. Continued oversnow vehicle use at current levels involves localized high risk to surface water quality along 22% of the road segments in the three park units. Snowmobile and snowplane use on Jackson Lake would continue the risk of moderate to major adverse impacts on water quality in the lake. The continued use of bio-based fuels by the park service and the availability of fuels in gateway communities may result in a minor decrease in pollutant deposition into snow, but could significantly reduce the persistence of emission products in aquatic systems.

Effects on Wildlife

General Effects

Winter recreation activities take place during the season when animals are stressed by climate and food shortages. Disturbance or harassment of wildlife during this sensitive time can have a negative effect on individual animals and, in some cases, populations as a whole (Moen et al. 1982). The most critical times for wildlife involve cold weather, late pregnancy, and other times when animals are in a state of negative energy balance (Geist 1978). The consequences of human-caused wildlife disturbance include: elevation of heart rate and metabolism; flight; displacement from habitats; reduced reproduction; increased susceptibility to predation; and diminished health as a result of increased energy costs (Moen et al. 1982; Geist 1978; Cassier et al. 1992; Picton 1999; Aune 1981). Thus, although animals may appear unaffected by human activities (Aune 1981), adverse effects may nonetheless be occurring. In YNP's Madison, Firehole, and Gibbon

River valleys, Aune (1981) reported that wildlife developed crepuscular patterns in response to winter recreation activity, were displaced from trailsides, and that their movements were inhibited by traffic and snow berms created by plowing and grooming operations.

Ream (1980) reviewed 232 publications on the impacts of recreation on wildlife, and concluded that in general living near small numbers of nonaggressive humans did not significantly impact wild animals. Recreationists, however, because of their numbers and sometimes inappropriate behavior, were causing severe impacts because of harassment and the habituation of particular species.

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative A, YNP maintains 184 miles of groomed motorized roads and 37 miles of groomed nonmotorized trails. GTNP (including the Parkway) maintains 36 miles of groomed motorized surfaces.

As described in Chapter III, biologists agree that bison use groomed roads in winter to travel to different foraging areas, but disagree as to the extent that they use roads or how this use affects population dynamics (Meagher 1993; Meagher et al. 1994; Bjornlie and Garrot 1998; Cheville et al. 1998; Kurz 1998; NPS 1998). A three-year monitoring project (Kurz et al. 2000) and another research project (Bjornlie 2000) showed that only a relatively small proportion of bison activity[33] involved the use of groomed roads (Bjornlie and Garrot 1998; Kurz 1998; Kurz et al. 2000; Bjornlie 2000). The amount of use varied by year, and may be related to snow depth and population size. Furthermore, bison use of roads was negatively correlated with road grooming, with peak periods of road use occurring before and after the winter use season (Bjornlie 2000). Data also indicated that bison were not using the groomed road surface for major shifts in distribution (Bjornlie and Garrot 1998; Bjornlie 2000). Instead, the vast majority of bison were described as traveling primarily along established game trails, geothermal areas, and river corridors.

On the other hand, long-term studies of bison population dynamics, distribution, and movements suggest that groomed roads have provided bison with increased access to foraging areas, and have facilitated population expansion and shifts in distribution (Meagher 1989; Meagher 1993; Meagher et al. 1994; Meagher 1998). Using the groomed roads to travel to existing and new foraging habitats reduces the energy costs relative to traveling through deep snow. Bison use of winter roads may have changed the energetics of bison ecology by facilitating shifts in the distribution of wintering groups

[33] An average of 7.6% of bison observations in the Hayden Valley study area were on the road during the winters of 1997-98, 1998-99, and 1999-2000 (Kurz et al. 2000). Bjornlie (2000) reported use of groomed roads to account for 17% of all observed travel in the Madison-Gibbon-Firehole area during the winters of 1997-98 and 1998-99.

within the YNP population, increasing the overall abundance of bison in the park, and leading to the dispersal of bison into new habitats within and outside YNP (Meagher 1993; Meagher et al. 1994).

In recent years, a number of bison have traveled from the preferred thermal habitats in the north central portion of YNP to other areas of winter range within and outside of park boundaries. Along the northern portion of YNP, bison may travel on ungroomed trails (e.g., the Yellowstone River Trail), game trails, or over open terrain to and through public lands outside YNP. They travel east of the Yellowstone River into the Eagle Creek/Bear Creek area, or west of the river through open terrain in the Stephens Creek area. Here they are currently prevented from moving onto private lands immediately adjacent and north of the YNP boundary. Along YNP's western boundary, bison may move to lands outside the park in the Cougar Creek and Duck Creek areas or they may travel along or near the Madison River to public lands in the Horse Butte area. Nearly all bison movement to the west appears to occur on game trails, open terrain, or along the Madison River, with the exception of a short section of road through the Madison Canyon, where use peaks in the fall and spring. Bison use of groomed roads was reported as highest in mid-winter (February – March) between Fountain Flats and Old Faithful along the Firehole River (Bjornlie 2000). According to Bjornlie (2000), changes in bison distribution and movement patterns over the past 30 years occurred as a result of natural range expansion as the population increased from near extirpation and began to use alternate foraging areas.

Elk, moose, and deer may also travel on groomed or packed routes (Tyers 1999; Aune 1981; Richens and Lavigne 1978). In one study, elk use of groomed routes in YNP increased throughout the winter as snow became increasingly deeper and more crusted and as animals' conditions declined (Aune 1981). In another study, deer mobility appeared to be enhanced by packed snowmobile trails during periods of deep snow in Maine (Lavigne 1976). It is unknown if the energy saved by walking on groomed routes is greater than the associated disturbance caused by traffic on these routes (Clark 1999).

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause injury and death to wildlife, especially in poor lighting conditions and during snowfall, and displacement from preferred habitats. Under alternative A, these effects are associated with about 184 miles of groomed road surface in YNP and about 72 miles of groomed and ungroomed surfaces for motorized use in GTNP and the Parkway. Although both snowmobiles and snowcoaches use these routes, impacts are associated with the sound, speed, and number of snowmobiles — there are no documented accounts of snowcoaches hitting and killing any large mammal in the park (Gunther et al. 1998).

Over a 10-year period ending in 1998, 14 ungulates were killed by snowmobiles in YNP, primarily between Madison Junction and the West Entrance (Gunther et al. 1998). Bison were the most commonly hit (10), followed by elk (3), and moose (1). The majority of

mortalities occurred in areas of ungulate winter range, thus alternatives for winter use that increase vehicular traffic (oversnow or wheeled) in these areas would likely increase the frequency of road-killed wildlife. There are no statistics that account for injuries or increased energy expenditures that may eventually lead to mortality. Impacts, including mortalities, related to oversnow motorized use are considered to be negligible relative to the size of the ungulate population. Gunther et al. (1998) estimated that the annual number of road-kills (for both oversnow and wheeled-vehicles) has been 1% or less of each species' total population.

Because moose instinctively stand their ground when faced with a perceived threat, they may be especially vulnerable to collisions. Under alternative A, Highway 89/287 and the Continental Divide Snowmobile Trail (CDST) would continue to intersect and parallel riparian habitat between the Buffalo Fork, Snake River, and Willow Flats. Therefore, collisions between moose and vehicles, although they involve a negligible percentage of the moose population, would continue at the present rate along this stretch.

In YNP Aune (1981) observed that snowmobile-bison interactions increased with snow depth. Although bison habituate to snowmobiles to some degree, when a response was elicited, it most often resulted in the bison fleeing, with snowmobiles frequently herding them down the packed trail. However, at the time of Aune's 1981 study, bison populations were increasing, so apparently disturbance and the extra energy expenditure associated with it were not decreasing reproductive success (Cherry and Kratville 1999). Bjornlie (2000) also observed bison responding to snowmobiles, and reported that 60% of all bison groups observed traveling on groomed roads had negative reactions, most of these reactions included running.

Displacement caused by human activities may be considered a form of habitat fragmentation because it prevents animals from using parts of their home range. Because elk are restricted to limited winter range where food and cover may be of marginal quality, any human winter activity that could prevent the species from using all or part of their winter range may have adverse effects on their ability to survive or successfully reproduce (Clark 1999). Increased access into elk winter range as provided by plowed and groomed roads may reduce the overall scale and effectiveness of elk habitat, and lead to increased harassment and energetic stress (Picton 1999).

Dorrance et al. (1975) studied the responses of two white-tailed deer (*Odocoileus virginianus*) herds, one that was habituated to snowmobile activity and one that was not. Behavioral responses of the habituated herd were of short duration: deer fled from snowmobiles but returned within several hours. Deer that were previously unexposed to snowmobiles exhibited greater response, increasing the size of their home ranges and becoming displaced from habitats near trails. Huff and Savage (1972) reported that snowmobiling activity forced white-tailed deer into less preferred habitats, and Richens and Lavigne (1978) found that snowmobiles moving at low speeds (<16 km/h) disturbed white-tailed deer less than snowmobiles at higher speeds. However, when people

stopped to view deer, they elicited the greatest response, causing the deer to flush. Although Aune (1981) observed many immediate behavioral responses to snowmobiles, he did not determine that winter recreation was a major factor influencing wildlife distribution, population or movement.

In the parks, bighorn sheep are not known to occupy winter habitats near oversnow motorized routes. Consequently, the potential for displacement of sheep from key winter range is not likely to occur as a result of snowmobile or snowcoach activity.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, may also provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative A, the effects described above are associated with about 76 miles of plowed road in YNP, including US Highway 191, a commercial 55 mph route linking the communities of West Yellowstone and Bozeman, Montana. GTNP (including the Parkway) maintains about 100 miles of plowed road.

Bison use plowed roads in a manner similar to groomed roads. In one study, 44% of bison groups observed reacted negatively to wheeled-vehicles (Bjornlie 2000). Portions of the plowed road between Old Faithful and West Yellowstone are used by a small percentage of bison in the spring as they search for areas with early vegetation (Bjornlie 2000); on the north side of the park, bison travel down the highway from Tower over Blacktail and down to Mammoth (Kurz, pers. com., 2000). This latter road intersects winter range and has been plowed since the 1940s. The extent to which it influences bison movements is unknown (Cherry and Kratville 1999).

Elk and moose also may travel on plowed routes. It is unknown if the energy saved by walking on groomed routes is greater than the associated disturbance caused by traffic on these routes. The snow berms associated with these routes may trap elk and other species and increase their susceptibility to collisions with vehicles (Clark 1999). Given the large size of the ungulate population in the parks relative to the number of animals that are impacted by snow berms, the effect is considered minor.

Snow berms and guardrails may impede bighorn sheep movements in YNP (Caslick 1993), but intentional use of roads as travel corridors has not been documented.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause displacement from preferred habitats and injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

As discussed above, displacement caused by human activities may be considered a form of habitat fragmentation because it prevents animals from using parts of their home

range. Because elk are restricted to limited winter range where food and cover may be of marginal quality, any human winter activity that could prevent the species from using all or part of their winter range may have adverse effects on their ability to survive or successfully reproduce (Clark 1999). Increased access for humans into elk winter range as provided by plowed and groomed roads may reduce the overall scale and effectiveness of elk habitat and lead to increased harassment and energetic stress (Picton 1999).

Morgantini and Hudson (1979) reported that weather conditions combined with harassment resulting from human activities associated with roads resulted in displacement of elk to marginal foraging areas in Alberta. Impacts were especially acute during severe winters when energy budgets were stressed.

During the winters from 1989-98, wheeled-vehicles accounted for 99% of all road-killed large mammals (predominantly ungulates) in YNP. Of the 1,090 animals killed, elk (427), mule deer (335) and bison (98) were the species most often involved in fatal collisions (Gunther et al. 1998). The majority of the collisions occurred on U.S. Highway 191, where both posted speed limits and actual speeds exceed those on the road from the North Entrance to Cooke City. Overall, considering all species, the average ratio of wheeled-vehicle road-kill mortality to snowmobile road-kill mortality was 17 to 1. Thus, alternatives that that change road use from snowmobiles to wheeled-vehicles would likely result in an increase in road-killed animals. The use of mass transit and enforcement of lower speed limits could ameliorate this effect.

In GTNP and the Parkway the CDST follows US Highway 89/287 from the eastern boundary of GTNP near Moran Junction to Flagg Ranch (see *Access and Circulation*) and parallels moose winter range in both the Buffalo Fork Valley and the northern edge of Willow Flats. The proximity of the road and trail inhibits the movement of moose within their winter range. Automobiles on the highway and snowmobiles on the trail conflict with moose as they attempt to cross the trail and road. Moose are particularly vulnerable to collisions with vehicles along this highway because the plowed road provides relief from snow conditions as well as a travel corridor to foraging areas. Moose use of this road in combination with their instinctive response of standing their ground in the face of a perceived threat make them particularly vulnerable to vehicles (Tyers 1998). Berms are constructed between the road and trail throughout the CDST to prevent snowmobile versus automobile conflicts and, in many locations, the trail surface is located substantially higher than the plowed highway. Therefore, moose using the CDST that are forced to exit onto the plowed roadway have a considerable drop (commonly greater than three feet) to negotiate. Occasional breaks are provided to allow moose to avoid vehicles and exit the CDST. These measures are not always effective as 6 to 15 moose-vehicle collisions occur each year.

Under alternative A, Highway 89/287 and the CDST would continue to intersect and parallel riparian habitat near the Buffalo Fork and Snake Rivers and Willow Flats. Therefore, collisions between moose and vehicles, although they involve a negligible

percentage of the moose population, would continue at the present rate along this stretch of highway.

In addition to mortality, wheeled-vehicles may also displace moose. In Denali National Park, a 50% increase in vehicular traffic over ten years corresponded with a 72% decrease in moose sightings along the main park road (Singer and Beattie 1986). In YNP, GTNP, and the Parkway, however, there is no evidence that traffic is significantly displacing moose.

In YNP the road between Gardiner, Montana and Mammoth, Wyoming intersects bighorn sheep winter range. Although off-road public access is restricted, traffic may disrupt sheep movement. Another affected area is sheep winter range between Mammoth, Wyoming and Cooke City, Montana. Traffic on the plowed road disrupts migration patterns and habitat use. In addition vehicles on both of these roads have killed five bighorn sheep in a 10-year period (Gunther et al. 1998). In Alberta, bighorn sheep subjected to predictable vehicular traffic exhibited few behavioral responses, thus sheep may become habituated to repeated traffic (MacArthur et al. 1982).

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. These effects are believed to be of a greater magnitude than those caused by motorized vehicles using established, predictable routes (Cole 1978; Schultz and Bailey 1978; Walter 1978; Aune 1981; Cassier 1986). Under alternative A, YNP maintains 37 miles of groomed nonmotorized trail, and with the exception of trails in the Mammoth Hot Springs and Blacktail Plateau areas, routes are not located in areas of high ungulate use. GTNP and the Parkway do not maintain groomed trails for nonmotorized use, but do provide 26 miles of designated ungroomed routes for nonmotorized use. These trails are not located in winter range.

Bison were found to respond noticeably to the presence of skiers who were off established trails (Aune 1981). Like elk, bison apparently habituate to some degree to repeated, predictable patterns of human activity on designated routes.

Elk are easily conditioned to predictable human activities, but tend to be disturbed by deviations of normal patterns (Ward et al. 1973). Consequently, skiing may affect elk behavior more than snowmobiling on established roads and trails (Aune 1981; Cassier et al. 1992). Cassier et al. (1992) measured elk movements when disturbed by cross-country skiers in YNP, and determined that the amount of winter range used by skiers and the number of days involved were more important factors than skier numbers. They recommended restricting skiers to more than 700 yards away from elk wintering areas to minimize elk displacement on shrub-steppe and upland steppe winter ranges.

In Alberta, elk moved away from heavily used ski trails, but skiing did not alter their overall wintertime distribution (Ferguson and Keith 1982). Aune (1981) reported snowmobiles on groomed roads resulted in an average elk flight distance of 38.8 meters, compared to average flight distance of 53.5 meters from skiing. Studies conducted outside the parks in Wyoming determined that elk preferred to be 0.5 miles distant from recreationists, and therefore recommended that people concentration areas should be at least this distance away from elk feeding sites (Ward et al. 1973)

Although moose are considered to be relatively tolerant of humans (Tyers 1999), winter recreation, including cross-country skiing, has been documented as a cause in displacing them (Rudd and Irwin 1985; Ferguson and Keith 1996). However, moose do habituate to predictable human activities (Tyers 1999). Consequently, nonmotorized activities on designated routes are considered to have negligible effects on moose.

The effects of skiing on bighorn sheep are restricted to the backcountry (i.e., non-designated routes) and are described below.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Overall, these effects are moderately disturbing, but short term.

The primary concern related to backcountry use and wildlife is effects on bighorn sheep. Both YNP and GTNP have designated Sheep Management Closures to protect sheep winter range. The closures in YNP encompass most bighorn winter range, and thus are effective in minimizing disturbance related to winter recreation in that park. In GTNP area closures at Static Peak and Kelly Flats would continue to protect some important bighorn sheep winter range from disturbance caused by backcountry winter recreation (i.e., skiing). However, under alternative A, other sheep winter ranges in GTNP would remain open to public use.

Activities outside of established routes are more disruptive to ungulates than activities on designated routes. Bison and elk were found to respond more quickly to skiers who were off established trails than to skiers who were on designated routes (Aune 1981). Tyers (1999) reported that moose in backcountry areas were more likely to run away from skiers than were moose in front country areas where skiers were more commonly encountered.

GTNP and the Wyoming Game and Fish Department are concerned with the impacts that skiers and snowshoers may be having on moose and elk on Blacktail Butte, and on elk and bison on Wolff Ridge (see Chapter III, *Ungulate Winter Ranges*). Specifically, these activities may be displacing these ungulates, and incurring upon them additional

energetic costs. Because alternative A does not restrict use of these areas, any potential impacts would continue.

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Under alternative A, a warming hut would be constructed at Norris in the vicinity of ungulate winter range important to elk, deer, and bison. Introducing winter human use into this area would reduce its habitat effectiveness by potentially causing these species to be displaced to lower quality habitats. However, over time, the predictable nature of the recreation expected to occur in the area may allow these species to habituate to the increase in human activity.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow. Under alternative A, YNP maintains 184 miles of groomed motorized roads and 37 miles of groomed nonmotorized trails. GTNP maintains 36 miles of groomed motorized roads including the Parkway.

Groomed roads do not affect bald eagles or grizzly bears.

Groomed routes could affect wolf-prey interactions and habitat use (Thurber 1994; Paquet et al. 1998). However, the ecological significance of altering natural movement and foraging patterns is not fully known (Reinhart 1999). Furthermore, wolves in YNP have not been documented to travel on groomed snowmobile routes (Smith, pers. com., 2000).

Lynx may be affected by groomed routes because snow compaction may enable other predators, especially coyotes, to compete in deep snow conditions where lynx would otherwise have an advantage (Bider 1962; Ozoga and Harger 1966; Murray and Boutin 1991; Koehler and Aubry 1994; Murray et al. 1995; Lewis and Wenger 1998; Buskirk et al. 1999). Increased competition may reduce the value of habitat for lynx, and may exclude them altogether (USFS 1999). The degree to which packed trails may affect interspecific competition among lynx and other predators is poorly understood (USFS 1999); no studies in the GYA exist that document this relationship. The rapid recolonization of wolves to the parks may reduce coyote populations and consequently reduce the risk of coyote competition with lynx (USFS 1999). The investigation of lynx and lynx habitat use in the parks is a prerequisite to assessing impacts to lynx and is a high priority for the NPS.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. Under alternative A, the effects described above are associated with about 184 miles of groomed road surface in YNP (for both motorized and nonmotorized use) and about 72 miles of groomed and ungroomed surfaces for motorized use only in GTNP and the Parkway. To date, no federally protected species have been killed by collisions with snowmobiles or snowcoaches in the parks.

The primary effect of oversnow, motorized use on bald eagles is displacement of foraging eagles, especially along river corridors (e.g., the Madison River from the West Entrance to Madison Junction; the Firehole River to Old Faithful; the Gibbon River near Norris; and the Yellowstone River from Fishing Bridge to Canyon). In GTNP and the Parkway oversnow motorized traffic would not be expected to disturb eagles because the travel corridor does not closely follow the Snake River. Disturbance to breeding eagles would be minimal because eagle breeding activities initiate as winter activities begin to decrease in the parks in late February (McEneaney, pers. com., 2000). Furthermore, only one eagle nest is visible from the roadside in YNP and in GTNP under current park policy, areas within a 0.5-mile radius around bald eagle nests on the Snake River are closed to public access beginning February 15. Disturbance caused by snowmobiles on the frozen surface of Jackson Lake would continue to cause only negligible impacts to eagles because foraging and nesting activities would be minimal prior to the breakup of the ice. In all park units, if monitoring indicates disturbance to bald eagles, additional closures may be enacted.

Few data exist on the impacts of human activity on denning grizzly bears (Reinhart and Tyers 1999). The following excerpt is from the Montana Chapter of the Wildlife Society's review of recreation impacts to denning grizzly bears (Claar et al. 1999):

> Winter motorized recreation can be associated with defined routes or dispersed over the landscape. Mace and Waller (1997) reported no den abandonment by grizzly bears in the northern Swan Range, Montana, although they routinely observed snowmobile activity within 2 km of grizzly bear dens. The den sites were usually located on steep timbered slopes that the researchers believed were nearly impossible for snowmobiles to traverse. However, Harding and Nagy (1980) reported den abandonment due to hydrocarbon exploration activities in Northwest Territories, Canada. Reynolds et al. (1986) reported on the responses of denning grizzly bears in Alaska to winter seismic surveys, including snowmachines, drill rigs, aircraft, and detonation of dynamite. Detonations within 0.8-1.2 miles of denning bears did not cause abandonment, but movements within dens were noted in some cases. A female with yearlings did not abandon her den when vehicle use was occurring within 325 feet. They reported probable den abandonment by an unmarked bear when seismic activity was within 650 feet of the den. When vehicles operated within about 3,300 feet of denned bears, their heart rates were elevated compared to undisturbed

conditions. The heart rate of denned bears increased in response to overflights by small aircraft near the time of den emergence but not at other times.

Although abandonment of dens was not reported as a frequent result of the winter human uses described, Reynolds and Hechtel (1980), Watts and Jonkel (1989) and Mace and Waller (1997) expressed concern that the physiological stresses could result in serious consequences to bears. Mace and Waller (1997) believed that the greatest potential for disturbance from snowmobile activity occurs when females with cubs are still confined to the den vicinity during spring and when bears descend to lower elevations and more gentle terrain, which is more suitable to snowmobiling.

Any potential effects of recreation on denning bears are ameliorated because, in the parks, preferred denning habitats are generally remote (Gunther, pers. comm.), and snowmobiles are required to stay on designated routes.

Of greater concern are the effects of human activities that occur near important grizzly bear foraging habitats during the pre- and post-denning period. Whether or not conflicts occur is largely dependent upon the number of visitors in the parks, where recreational activities occur, and the abundance and distribution of natural bear foods in any given year. During years of high whitebark pine production, bears are not as likely to come into conflict with human activities prior to denning because this food source occurs at high elevations in remote, less visited areas. Most bear management actions occur in the early to mid-fall, prior to the initiation of the winter use season, when the whitebark pine seed crop has failed and bears seek out human sources of food, including garbage (Gunther, pers. comm.). Park policy currently calls for closing areas of high bear use at any time to reduce the risk of bear-human conflicts.

The likelihood of visitors encountering grizzly bears in the initial weeks of the winter use season (mid- to late December) is extremely small as the vast majority of bears (about 96%) have denned by the second week of December (Haroldson et al. in prep). To date, no conflicts have occurred during this period (Gunther, pers. com., 2000).

Winter activities in late February and March may conflict with emerged male grizzly bears, 31% of which are out of their dens by March 15 (Haroldson et al. in prep). In particular, activities in ungulate winter range may disturb grizzly bears feeding on winter-killed carcasses. In YNP ungulate winter range includes geothermally influenced areas in the Firehole, Gibbon, and Norris vicinities where the potential for human-bear conflict in the spring is high (Reinhart and Tyers 1999).

To date, only one bear-human conflict has occurred prior to April in the parks (Gunther, pers. com., 2000; Cain, pers. com., 2000). According to YNP's Bear Management Area Program, many important grizzly bear spring foraging areas are closed to the public beginning March 15 to reduce displacement of bears and bear-human conflicts. For example, the Old Faithful area, where bears graze on thermally influenced spring

vegetation and scavenge winter-killed carcasses, is closed from the third Sunday in March through April 14. From April 14 through Memorial Day weekend at the end of May, 20,670 acres of the most important ungulate winter range in the area remains closed to all recreational use. Consequently, grizzly bears have undisturbed use of most winter-killed ungulate carcasses in the Old Faithful area during the entire spring season. Furthermore, before opening areas to the public, winter-killed carcasses that remain within the developed area boundaries or within 100 yards of open roads are moved to areas away from human activity. With the exception of the road from Mammoth to Cooke City, other roads within YNP are closed to public entry by March 15 (latest closing date), and most roads will remain closed to all public vehicles until at least April 15 (earliest opening date).

Impacts associated with the use of motorized oversnow vehicles on gray wolves are related to disturbance. Wolves have been documented to avoid areas of snowmobile activity thus becoming permanently displaced from some habitats (Carbyn 1974; NPS 1996); however, wolves in YNP have not been documented to travel on groomed snowmobile routes (Smith, pers. comm.). Wolves do use areas near groomed snowmobile roads in ungulate winter range, and in 1997, a pack was displaced from an elk carcass by snowmobiles (Smith 1998). In GTNP continued snowmobile use in the Antelope Flats and Ditch Creek areas could cause some disturbance to wolves due to noise and human activity. However, snowmobiles are required to stay on designated routes, preventing random use of the area.

Impacts to denning wolves would not be expected to occur because wolves den in April, after the closure of the winter recreation season in the parks. In accordance with park policy, areas within a 1-mile radius of the dens are closed to public entry in YNP; GTNP also has the authority to enact closures. In addition in YNP, many of the wolf dens are within grizzly bear spring closure areas, and thus are not subjected to disturbance from humans.

Motorized routes pass through potential lynx habitat in the parks. Assessing the degree of impacts to lynx in the parks is speculative because very little is known about lynx distribution and abundance. Motorized oversnow recreation may affect lynx by fragmenting habitat, reducing the effectiveness of intact habitat, causing displacement from or avoidance of habitat, and creating added energetic stress (Halfpenny et al. 1999). Impacts to breeding lynx would not be expected to occur because the winter recreation season ends prior to the initiation of the breeding season.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). In addition similar to groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative A, the effects described above are associated with about 76 miles of plowed road in YNP, including US Highway 191, a commercial 55 mph route

linking the communities of West Yellowstone and Bozeman, Montana. GTNP, including the Parkway, maintains about 100 miles of plowed road.

Plowed roads do not affect bald eagles.

The current winter season in YNP occurs from mid-December to mid-March. The majority of bears have denned prior to the beginning of the winter season. Consequently, plowed roads are not expected to affect grizzly bears. See *Effects of motorized use of groomed and ungroomed roads and trails* for additional information on grizzly bears and winter use.

Similar to the effects of groomed roads, plowed roads could potentially affect wolf-prey interactions and habitat use (see *Effects of groomed roads and trails*). However, wolves in the parks have not been documented to use plowed roads as travel corridors (Smith, pers. comm.).

Lynx have been documented to travel along roadways providing that adequate cover is available on both sides of the road (Koehler and Brittell 1990). Any vegetative cover along plowed roadsides in the parks is generally buried under the snow; consequently, it is doubtful that lynx, which require cover for security and for stalking prey (Koehler 1990), would use these roads as travel corridors. Most impacts associated with roads are related to traffic volumes and are discussed below.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those of traffic on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

Motorized vehicles may strike bald eagles foraging on carcasses along roadsides, in particular wheeled-vehicles on Highway 191 and on the road from Mammoth to Cooke City. To date, only one bald eagle mortality has been attributed to a vehicle; it was hit on Highway 191 on the northwest side of YNP (McEneaney, pers. comm.). Park policy requires that carcasses on and along roads be routinely removed to avoid attracting bald eagles and other scavengers. Eagles may also be displaced from perches by traffic on these road segments, although such displacement is considered minor and short term due to the fidelity bald eagles have to their traditional perches (McEneaney, pers. comm.). Chronic disturbance, may, however, ultimately cause bald eagles to abandon their perch sites (Cain, pers. comm.). No evidence exists, however, to suggest that bald eagles are being chronically disturbed in the parks.

Although grizzly bears generally avoid road corridors (Reinhart and Tyers 1999), bears may be attracted to carrion found along or near roads during the pre- and post-denning period, thereby making them vulnerable to collisions with wheeled-vehicles. During a 10-year period, wheeled-vehicles killed two grizzly bears during the winter use season

(Gunther et al. 1998). Displacement is not likely to occur because the majority of bears have denned during this time. See *Effects of motorized use of groomed and ungroomed roads and trails* for additional information regarding grizzly bear activity and winter recreation.

From 1995-98, vehicles killed six wolves during the winter use season in YNP (Gunther et al. 1998). In general, wolves avoid roads that are open to the public, but have been documented to use closed or limited use roads (Thurber et al. 1994; Carbyn 1974). In YNP wolves cross roads periodically, but little use of roads as travel corridors has been documented (Smith, pers. comm.). The likelihood of wolves being hit by automobiles is highest for those packs that inhabit areas on the north side of YNP, and to a lesser degree, packs in GTNP.

Although a possibility, there are few records of lynx being killed on highways (USFS 1999) and no road-killed lynx have been documented in the GYA (Halfpenny et al. 1999). Carnivore research in Canada suggests that traffic volumes of 2,000 to 3,000 vehicles a day are problematic in terms of lynx being killed on highways (USFS 1999). Winter traffic levels in the parks do not approach this volume. Other effects of wheeled-motorized traffic on lynx are similar to the effects of oversnow motorized traffic. Both may displace individual lynx or cause them to avoid certain habitats. Wheeled-vehicles can also impact hare abundance and activity at night, thereby affecting an important food source for lynx.

Fragmentation of potential lynx habitat would continue to occur under alternative A because several road sections in the parks intercept lynx habitat. In YNP the effects are limited to US Highway 191 along the western boundary of the park. In GTNP US Highway 89/287 from Moran Junction to Flagg Ranch intercepts potential lynx habitat.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. These effects are believed to be greater than those caused by motorized vehicles using established, predictable routes (Cole 1978; Schultz and Bailey 1978; Walter 1978; Aune 1981; Cassier 1986). In addition packed ski trails may influence wildlife movements and distributions by allowing access to areas outside of their normal range. Under alternative A, YNP maintains 37 miles of groomed nonmotorized trail. GTNP and the Parkway do not maintain groomed trails for nonmotorized use, but do provide 26 miles of designated ungroomed routes for nonmotorized use. The area affected by nonmotorized trails in the parks is very small relative to the total area of the park units. Minor site-specific impacts are possible where trails occur in or near nesting sites or foraging areas. Nonmotorized uses of groomed and ungroomed routes occur primarily where vehicular access permits easy access.

In contrast to motorized activities, nonmotorized recreation (e.g., cross-country skiing), especially when it occurs outside of predictable use areas or in riparian areas, may be highly disruptive to bald eagles (Harmata and Oakleaf 1992; Grubb and King 1991; Stalmaster and Newman 1978; McGarigal et al. 1991; Stangl 1994). In YNP this includes areas along the Firehole, Madison, Yellowstone, and Lewis Rivers. In GTNP the most important bald eagle wintering area, the Snake River floodplain, is entirely closed to public access in the winter. Although recreational activities may occasionally displace eagles from perches, the displacement is considered negligible and short term due to the fidelity bald eagles have to their traditional perches (McEneaney, pers. com., 2000). Chronic disturbance, may, however, ultimately cause bald eagles to abandon their perch sites (Cain, pers. com., 2000). No evidence exists to suggest that bald eagles are chronically disturbed in the parks. In all park units, if monitoring indicates disturbance to bald eagles, additional closures may be enacted. Furthermore, disturbance to breeding eagles would be minimal because eagle breeding activities initiate as winter activities begin to decrease in the parks in late February. Under current park policy, areas within a 0.5 mile radius around bald eagle nests on the Snake River are closed to public access beginning February 15.

Nonmotorized recreation is not likely to adversely affect grizzly bears because the majority of bears have denned during the period of winter use. See *Effects of motorized use of groomed and ungroomed roads and trails* for additional information regarding grizzly bear activity and winter recreation.

Nonmotorized groomed trails pass through wolf winter range in YNP and could negatively affect predator-prey relationships. To date in YNP, this has not been documented to occur. In GTNP wolf activity in the winter is sporadic, and generally focused in areas of relatively low human use.

Front country nonmotorized activities may occur in potential lynx habitat. Because the abundance and distribution of lynx in the parks is unknown, it is difficult to assess the impact of these activities. The majority of skiers in the parks remain on groomed routes, therefore use is largely predictable. With the exception of human activity near den sites, many researchers believe that lynx may be relatively tolerant of humans (USFS 1999). Bowles (1995) reported that lynx may adapt to some level of human activity, and other researchers documented lynx use of ski areas and winter construction camps in Colorado (Halfpenny et al. 1982; Thompson 1987; Thompson and Halfpenny 1989 and 1991).

Minimizing disturbance to denning habitat is important from May to August (USFS 1999); consequently, winter recreation in the parks will not affect denning lynx.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and federally protected wildlife species may only occur sporadically, they may cause

displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction.

The effects of nonmotorized recreation in backcountry areas on bald eagles would likely be greater than those on designated routes in the front country (Harmata and Oakleaf 1992; Grubb and King 1991; Stalmaster and Newman 1978; McGarigal et al. 1991; Stangl 1994). Nonetheless, the effects of current winter use on eagles are not considered a major concern in the parks (McEneaney, pers. com., 2000). See *Effects of nonmotorized use on groomed and designated ungroomed routes* for a discussion of nonmotorized activities and bald eagles.

Nonmotorized recreation in high-elevation backcountry areas frequented by grizzly bears immediately before and after denning may potentially result in bear-human conflicts. Conflicts may result in management actions taken against individual bears, including translocation (most commonly) and lethal control (rarely). By mid-December the majority of bears have denned, therefore the chance of backcountry skiers encountering bears is low. Likewise, although some bears will be out of their dens during the first two weeks of March, the odds of bear-human interactions are minimal.

Impacts to bears are more likely to occur prior to and following the winter use season as bears seek out feeding opportunities. Backcountry recreation at these times may lead to conflicts, potentially resulting in management actions taken against individual bears including translocation and lethal control. Management actions may also occur as a result of human-caused displacement of grizzly bears, or when bears seek food attractants at park developments during years of low natural food availability (primarily whitebark pine seeds). Similarly, displaced bears may be attracted to park developments and other sources of human food. Current Bear Management Area restrictions (see *Effects of motorized use of groomed and ungroomed roads and trails*) serve to minimize bear-human confrontations in spring.

Nonmotorized groomed trails pass through wolf winter range in YNP and could negatively affect predator-prey relationships. To date in YNP, this has not occurred. In GTNP wolf activity in the winter is sporadic, and generally focused in areas of relatively low human use.

Nonmotorized, backcountry recreation may affect lynx because disturbance is dispersed and unpredictable (Schultz and Bailey 1978; Gabrielson and Smith 1995). With the exception of habitat that is intercepted by roads, the majority of potential lynx habitat occurs in the backcountry and takes considerable effort to access. Consequently, the number of skiers potentially present in most lynx habitat in the winter is expected to be low and their odds of encountering or displacing lynx is small. Regardless, restrictions on backcountry use may be implemented at anytime to protect important lynx habitat.

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species due to the presence of human food and

garbage, and can subsequently lead to human-wildlife conflicts. In addition increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Effects of such disturbance would be the same as those previously discussed. Under alternative A, a warming hut would be constructed at Norris.

Winter support facilities in the parks are not known to affect bald eagles.

A major problem associated with human development in occupied bear habitat is the availability of food attractants. Bears that become conditioned to human foods and garbage are often the targets of management actions, including lethal control. High winter visitor use has contributed to a garbage problem in YNP. Garbage that has accumulated throughout the winter may attract hungry grizzly bears in the spring. To date, YNP does not have adequate winter garbage storage facilities but will rectify this issue by constructing a winter garbage storage facility that is wildlife-proof in the Old Faithful, Grant, Lake, and Canyon areas. This is a feature of all alternatives.

In YNP the construction of a warming hut at Norris will likely lead to an increase in human activity in the surrounding area. Because the hut will be located in thermally influenced ungulate winter range, any associated increase in human use could affect the availability of bison and elk carcass, which provide important spring foods for grizzly bears. Because ungulates have been known to habituate to predictable human activities any displacement would most likely be short term. In addition as stated previously, the majority of bears do not emerge from hibernation until after the winter use season at which time the Bear Management Area restrictions will be in affect to allow bears uninterrupted use of spring carcass habitats in known winter ranges. Areas of high bear use may be closed at any time according to park policy.

Wolves may be affected in the short term by ungulate displacement in the Norris area.

The increase in human use expected in the Norris area as a result of the new warming hut is not expected to affect lynx because the hut is outside of potential lynx habitat.

Species of Special Concern.

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow; inhibit foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey; and, reduce subnivian prey availability by increasing mortality of these small mammals. Under alternative A, YNP maintains 184 miles of groomed motorized roads and 37 miles of groomed nonmotorized trails. GTNP maintains 36 miles of groomed motorized roads including the Parkway.

Because so few studies of wolverine ecology exist, it is unknown if wolverines would use groomed routes. Because wolverines are considered especially sensitive to human disturbance (Copeland 1996), it is unlikely that they would use routes frequently traveled

by humans. The maintenance of the Sylvan Pass groomed route requires periodic blasting to alleviate the risk of avalanches. This practice may affect wolverines and wolverine habitat in the Sylvan Pass area.

The scarcity of fisher sightings in the parks and the paucity of studies on this species inhibit an assessment of the impacts of winter use. They are known to travel on packed snowshoe hare trails or reuse their own trails when snow is deep (Trochta 1999); consequently, the potential exists for fishers to use groomed routes. However, the fisher has been described as a species that typically avoids humans (Powell and Zielinski 1994); thus, it may be inferred that they would not frequent these routes very often due to their associated high levels of human activity.

American marten tunnel beneath the snow to prey upon small mammals. Raine (1983) found that martens hunted beneath the snow less often when it was crusty and compacted. Furthermore, prey may be less available in these areas as a result of displacement and increased mortality caused by compaction (Trochta 1999). Martens reportedly use packed snow trails created by other animals to conserve energy (Strickland and Douglas 1987); therefore, it may be inferred that they may also use groomed trails to some extent.

River otters closely associated with aquatic and riparian habitats seldom venture far from water, and otter would not be expected to make use of groomed routes. Indirect effects to otters related to the impact of motorized oversnow recreation on the aquatic environment are discussed below.

Impacts on trumpeter swans are associated with motorized traffic on groomed routes (discussed below), and not the routes themselves.

Sagebrush lizards hibernate throughout the winter use season but may be impacted by winter activities that disturb rocky, geothermal areas. Groomed routes would not affect sagebrush lizards because they are restricted to the road footprint and consequently do not alter the rocky substrates preferred by this species.

Impacts on rubber boas, fish, and amphibians are limited to activities that affect the aquatic environment. In regards to winter use, these impacts are limited to the use of motorized oversnow recreation.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts on species of special concern in the parks are displacement from preferred habitats and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare. In ten years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998). Under alternative A, the effects described above are associated with about 184 miles of groomed road surface in YNP and about 72 miles of groomed and ungroomed surfaces for motorized use in GTNP and the Parkway.

Habitat displacement of wolverines has been documented to occur outside the parks, with wolverines rarely using parts of their home range bisected by roads (Arthur et al. 1989; Copeland 1996; Gunther et al. 1997 and 1999). It is unknown whether wolverines use or are affected by groomed roads in the parks.

Because there is a chance that fishers, if they exist in the parks, may use groomed routes, the possibility for fishers to be affected by traffic on these routes also exists. However, the fisher has been described as a species that typically avoids humans (Powell and Zielinski 1994). Thus, it may be inferred that they generally avoid these routes due to their associated high levels of human activity. Impacts associated with displacement would be negligible because vast areas exist in the parks that are off-limits to snowmobile and snowcoach use.

American martens may be displaced by snowmobile and snowcoach activities, but similar to fishers, the impact would be negligible because vast areas exist in the parks that are off limits to snowmobile and snowcoach use.

Species that are associated with aquatic habitats (river otters, fish, and amphibians) may be indirectly affected by the impact of motorized oversnow recreation on the aquatic environment. The river otter's piscivorous diet and high position on the food web may make it especially vulnerable to water pollution (Melquist and Dronkert 1987). Direct discharge of snowmachine exhaust into the snowpack may create elevated contamination by hydrocarbons, carbon monoxide, nitrous oxides, and particulate matter, which may end up in aquatic ecosystems, including sensitive amphibian habitats (Ruzycki and Lutch 1999). These contaminants can lead to loss of overall health of amphibian populations and result in direct and indirect mortality of aquatic resources (Adams 1974). See *Water and Aquatic Resources* for an assessment of the impacts of exhaust on water quality in the parks.

Sagebrush lizards hibernate throughout the winter use season but may be impacted by winter activities that disturb rocky, geothermal areas. Oversnow motorized routes do not occur in these areas and consequently would not affect sagebrush lizard habitat.

In YNP trumpeter swans that winter along the Lewis, Firehole, Madison, and Yellowstone Rivers may be affected by motorized oversnow traffic, but disturbance is considered minor (Wyoming Game and Fish Department, McEneaney, pers. com., 2000). In GTNP impacts from motorized use are considered negligible because groomed and ungroomed routes for motorized oversnow use are not immediately adjacent to wintering areas. Similar to bald eagles, swans demonstrate more tolerance to continually moving vehicles than they do to stopped ones or people on foot or skis (Shea 1979; Aune 1981). In the parks, the predictability of vehicles on groomed or otherwise designated routes allows swans to habituate to traffic thus alleviating impacts related to disturbance.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative A, the effects

described above are associated with about 76 miles of plowed road in YNP, including US Highway 191, a commercial 55 mph route linking the communities of West Yellowstone and Bozeman, Montana. GTNP, including the Parkway, maintains about 100 miles of plowed road.

Because so few studies of wolverine ecology exist, it is unknown if wolverines would use plowed routes. Because wolverines are considered especially sensitive to human disturbance (Copeland 1996) it is unlikely that they would use routes frequently traveled by humans. Habitat displacement of wolverines has been documented to occur outside the parks, with wolverines rarely using parts of their home range bisected by roads (Arthur et al. 1989; Copeland 1996; Gunther et al. 1998 and 1999).

Little information exists that documents the effects of plowed roads on fishers. Anecdotal information from Alberta documented three individual fishers using snowplow banks as vantage points to hunt hares browsing on saplings in the rights-of-way (Johnson and Todd 1985).

The effects of plowed roads on marten movements are unknown.

River otters are closely associated with aquatic and riparian habitats, seldom venturing far from water. Therefore, otters would not be expected to make use of plowed roads as travel corridors, but may occasionally cross roads that bisect riparian habitats.

Impacts to trumpeter swans are associated with motorized traffic on plowed roads (discussed below), and not the roads themselves.

Sagebrush lizards hibernate throughout the winter use season but may be impacted by winter activities that disturb rocky, geothermal areas. Consequently, plowed roads would not affect sagebrush lizard habitat.

Impacts to rubber boas, fish, and amphibians are limited to activities that affect the aquatic environment. In regards to winter use, these impacts are limited to the use of motorized oversnow vehicles and their effects on water quality. See *Water and Aquatic Resources* for an assessment of the impacts of exhaust on water quality in the parks.

Effects of motorized use of plowed roads. The most likely impacts to park species of special concern are displacement from preferred habitats and mortality caused by collisions.

As stated previously, habitat displacement of wolverines has been documented to occur outside the parks, with wolverines rarely using parts of their home range bisected by roads (Arthur et al. 1989; Copeland 1996; Gunther et al. 1997 and 1999). Therefore, it is possible that plowed roads and traffic affect wolverines in the parks. Because vast areas exist in the parks that are not roaded, any effects related to the use of wheeled-vehicles on plowed roads would be limited.

Fishers, like wolverines, require contiguous blocks of habitat. Within their home ranges they reportedly rarely use areas bisected by roads (Arthur et al. 1989; Copeland 1996; Gunther et al. 1997 and 1999). Because vast areas exist in the parks that are not roaded, any affects related to the use of wheeled-vehicles on plowed roads would be limited.

The effects of wheeled-vehicle traffic on marten habitat use in the parks are unknown. Similar to fishers and wolverines, the impact would be negligible because vast areas exist in the parks that are not roaded. From 1989-98, wheeled-vehicles killed 18 marten in the winter in YNP (Gunther et al. 1998).

River otters are closely associated with aquatic and riparian habitats, seldom venturing far from water. Nonetheless, wheeled-vehicles killed a total of seven otters from 1989-98 in YNP (Gunther et al. 1998). The effects of wheeled-vehicle traffic on otter habitat use in the parks are unknown.

Under current management, there are no plowed roads immediately adjacent to open water habitats for trumpeter swans in YNP. In GTNP swans may use open water habitats of the Snake River near US Highway 287/89/191, but displacement has not been a significant issue, possibly because swans have habituated to the predictable nature of the traffic on this highway.

Sagebrush lizards hibernate throughout the winter use season and consequently are not affected by wheeled-vehicles on plowed roads.

Impacts to rubber boas, fish, and amphibians are limited to activities that affect the aquatic environment. In regards to winter use, these impacts are limited to the use of motorized oversnow vehicles and their effects on water quality.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. These effects are believed of greater magnitude than those caused by motorized vehicles using established, predictable routes (Cole 1978; Schultz and Bailey 1978; Walter 1978; Aune 1981; Cassier 1986). Under alternative A, YNP maintains 37 miles of groomed nonmotorized trail. GTNP and the Parkway do not maintain groomed trails for nonmotorized use, but do provide 26 miles of designated ungroomed routes for nonmotorized use. The area affected by nonmotorized trails in the parks is very small relative to the total area of the park units. Minor site-specific impacts are possible where trails occur in or near nesting sites or foraging areas. Nonmotorized uses of groomed and ungroomed routes occur primarily where vehicular access permits easy access.

Copeland (1996) reported that human activity near denning wolverines might cause them to abandon their dens thus potentially affecting reproductive success. Because denning occurs in late February to early March, it is possible that winter recreation could affect

denning wolverines. However, wolverines typically den in high-elevation, subalpine cirque basins (Trochta 1999), therefore any affect associated with winter recreation would be limited to backcountry travel (discussed below).

Fishers, especially when denning, may be sensitive to human disturbance (Trochta 1999). Because very little is known about this species and their distribution in the parks, it is difficult to assess the potential degree of impact from winter recreation, including nonmotorized use.

Little is known about the sensitivity of martens to human activity. They are described as inquisitive and may show greater tolerance than wolverines or fishers, having been found in areas of high human activity (Strickland and Douglas 1987).

Arrhythmic variations in activity patterns have been observed in river otters as a result of individual differences and human activity (Melquist and Dronkert 1987), with otters exhibiting more nocturnal or crepuscular activity in disturbed areas. How winter recreation may affect otters in the parks is unknown.

Swans have shown greater displacement behavior to people on foot or skis than to motorized traffic (Shea 1979; Aune 1981). They are especially sensitive during the breeding season, which occurs outside of the period of winter use. Skiing or snowshoeing near open water habitats may cause swans to flush; however, this is not considered a major problem for swans in the parks (McEneaney, pers. com., 2000).

Sagebrush lizards hibernate throughout the winter use season but may be impacted by winter activities that disturb rocky, geothermal areas. Consequently there is a small potential that visitors to sensitive geothermal areas may disturb lizard habitats.

Impacts to rubber boas, fish, and amphibians are limited to activities that affect the aquatic environment. In regards to winter use, these impacts are limited to the use of motorized oversnow vehicles and their effects on water quality.

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and species of special concern may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction.

Protection of natal denning habitat from human disturbance is critical for wolverine and fisher persistence (Copeland 1996; Arthur et al. 1989). Backcountry use is largely unregulated and may displace wolverines from critical denning sites and forage areas. Wolverine denning habitats are remote, rugged, and difficult to access. Consequently the odds of backcountry skiers disturbing denning wolverines are low.

Fishers, especially when denning, may be sensitive to human disturbance (Trochta 1999). Because very little is known about this species and their distribution in the parks, it is difficult to assess the potential degree of impact from winter recreation, including nonmotorized use.

Little is known about the sensitivity of martens to human activity. They are described as inquisitive and may show greater tolerance than wolverines or fishers, having been found in areas of high human activity (Strickland and Douglas 1987).

Arrhythmic variations in activity patterns have been observed in river otters as a result of individual differences and human activity (Melquist and Dronkert 1987), with otters exhibiting more nocturnal or crepuscular activity in disturbed areas. How winter recreation may affect otters in the parks is unknown.

Swans have shown greater displacement behavior to people on foot or skis than to motorized traffic (Shea 1979; Aune 1981). They are especially sensitive during the breeding season, which occurs outside of the period of winter use. Skiing or snowshoeing near open water habitats may cause swans to flush; however, this is not considered a major problem for swans in the parks (McEneaney, pers. com., 2000).

Sagebrush lizards hibernate throughout the winter use season but may be impacted by winter activities that disturb rocky, geothermal areas. Consequently there is a small potential that visitors to sensitive geothermal areas may disturb lizard habitats.

Impacts to rubber boas, fish, and amphibians are limited to activities that affect the aquatic environment. In regards to winter use, these impacts are limited to the use of motorized oversnow vehicles and their effects on water quality.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on park species of special concern are associated with increases in human activity and the subsequent disturbance and displacement of species or their prey. Habituation is not a concern for the species discussed below.

Under alternative A, the only new support facility would be the construction of a warming hut at Norris. This hut would be located in thermally influenced ungulate winter range. It is possible that increased human presence in the area may displace ungulates and consequently lower the availability of carcasses for wolverines, fishers, and martens. The effect would be minor and short term as ungulates habituate to human activity in the area.

Potential impacts to river otters would be limited to those associated with increased human activity; specific effects are largely unknown.

The hut site would not be immediately adjacent to swan habitat; therefore, no effects on swans would occur.

Sagebrush lizards hibernate throughout the winter use season but may be impacted by winter activities that disturb rocky, geothermal areas. Consequently there is a small potential that hikers in sensitive geothermal areas may disturb lizard habitats.

Impacts to rubber boas, fish, and amphibians are limited to activities that affect the aquatic environment. In regards to winter use, these impacts are limited to the use of motorized oversnow vehicles and their effects on water quality. See *Water and Aquatic Resources* for an assessment of the impacts of exhaust on water quality in the parks.

Conclusion

Most impacts from winter recreation do not result in long-term effects to populations. The effects of plowed and groomed surfaces on ungulate movements may contribute to energy savings, but it is uncertain if energy saved is greater than associated effects incurred from displacement and overall disturbance. The effects of packed surfaces on carnivores, especially lynx, are unknown and in need of investigation. Mortalities resulting from collisions with wheeled-vehicles are much higher than with snowmobiles, and primarily affect ungulates. On a population level, road-kill mortalities are negligible to minor for all species, but loss of individuals of federally protected species (i.e., grizzlies and wolves) is a concern. No documented road-kills of large mammals exist for snowcoaches (Gunther et al. 1998). Nonmotorized recreation in the front country and backcountry, with the exception of bighorn sheep, is generally associated with minor to moderate effects, and has not presented a long-term threat to any park species. Backcountry skiers may be impacting the imperiled sheep population in GTNP and effects may be moderate to major without mitigation. The presence and use of winter support facilities may incur impacts due to habituation to human foods (primarily a problem for bears) and displacement of species sensitive to human activities. Displacement effects are considered negligible to minor, and habituation is mitigated by installation of wildlife-proof winter garbage facilities, a feature of all alternatives.

Although impacts to populations resulting from winter recreation are neither long term nor very significant, impacts to individual members of the population can be important, leading to death either directly from collisions or continued harassment, or indirectly through management actions taken as a response to habituation to human presence and food. Although concerned about impacts to individuals, for the most part (with the exception of federally protected species), the NPS bases management actions on the protection of populations of native animals. For example, see NPS 77, Natural Resources Management, Chapter II.

Ungulates

- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: (1) mortality caused by collisions – adverse, negligible, and short term, and (2) displacement from preferred habitats – adverse, moderate, short term.

- Effects of plowed roads on: (1) habitat fragmentation – adverse, minor, and short term; and (2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects.
- Effects of motorized use of plowed roads on: (1) mortality caused by collisions – adverse, minor, and short term; and (2) displacement from preferred habitats – adverse, moderate, and long-term.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, minor, and short term.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, moderate, and short term. Impacts to bighorn sheep in GTNP would be moderate to major and long-term if no mitigation is applied.
- Effects of the presence and use of winter support facilities on displacement – adverse, minor, and short term.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: (1) bald eagles, grizzly bears, and wolves — no effect; and (2) lynx – adverse, negligible to major and short term, depending upon lynx distribution and abundance in the parks.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – adverse, negligible, and short term for all species excluding the grizzly bear, which, for the most part, will not be active during the winter use season.
- Effects of plowed roads on: (1) habitat fragmentation – no effect on any of the listed species; and (2) animal movements – no known effect on any of the listed species.
- Effects of motorized use of plowed roads on: (1) mortality caused by collisions – adverse, negligible, and short term (bald eagles and grizzly bears); adverse, minor, and short term (wolves); no known effect to date on lynx; and (2) displacement from preferred habitats – adverse, negligible, and short term (bald eagles), no effect (grizzly bears); no known effect to date on wolves and lynx.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term (bald eagles); no effect (grizzly bears); no known effect to date on wolves and lynx.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, minor, and short term (bald eagles); adverse, negligible, short term (grizzly bears); no known effect to date on lynx and wolves.
- Effects of the presence and use of winter support facilities on displacement – no affect (bald eagles); adverse, negligible, and short term (grizzly bears, with mitigation); adverse, minor, and short term (wolves); no effect on lynx because the Norris Warming Hut will not be in lynx habitat.

Species of Special Concern

- Effects of groomed roads and trails on (1) animal movements – no known effect (wolverines); adverse, negligible, and short term (fishers, martens); no effect (otters, swans, reptiles, amphibians, and fish); (2) foraging activities – adverse, negligible, and short term (marten); no effect on the other species; and (3) subnivian prey availability — adverse, negligible, and short term (marten); no effect on the other species.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect (wolverine); adverse, negligible, and short term (fishers and marten); no effect (otters, reptiles, amphibians, and fish); adverse, minor, and short term (swans).
- Effects of plowed roads on animal movements – no known effect (wolverines, fishers, and martens); no effect (otters, swans, reptiles, amphibians, and fish).

- Effects of motorized use of plowed roads on (1) displacement from preferred habitats – adverse, negligible, and short term (wolverines, fishers, martens); no effect (otters, swans, reptiles, amphibians, and fish) and (2) mortality from collisions — adverse, negligible, and short term (otters and martens); no effect to date on other species.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect (wolverines); no known effect (fishers, martens, and otters); adverse, minor, and short term (swans); adverse, negligible, and short term (sagebrush lizard) no effect (rubber boa, amphibians, and fish).
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible, and short term (wolverines and sagebrush lizard); no known effect (fishers, martens, and otters); adverse, minor, short term (swans); no effect (rubber boa, amphibians, and fish).
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor, and short term (wolverines, fishers, and martens); no effect (swans, rubber boa, amphibians, and fish); no known effect (otters); adverse, minor, and short term (sagebrush lizard).

Mitigation

- Closures around wolf dens and swan and eagle nests would continue to be implemented. Closures would be posted and enforced for the duration of time during which the species is most sensitive to human disturbance.
- The monitoring and evaluation of backcountry nonmotorized use in GTNP should be enhanced and closures to use should be implemented as warranted.
- Ramps or pullouts where moose could exit plowed roads to reduce collisions between snowmobiles and moose along the CDST would be provided.
- Use of groomed and plowed surfaces by bison and other ungulates would continue to be monitored.
- Snow track surveys for carnivores (including lynx) on both groomed and ungroomed routes would be conducted.

Effects on Natural Soundscape

Audibility analysis — combined effects of all wheeled and oversnow vehicles.

Table 72 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet", as defined in the *Assumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: (1) audible for any amount of time (labeled "audible at all"); (2) audible for 10% of the time or more; and (3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

The results show that for the no action alternative, under average background sound level conditions during the time during the day, oversnow and/or wheeled-vehicles would be audible to some degree for over 181,000 acres in the three park units. For over 94,000 of those acres, oversnow or wheeled-vehicles would be audible for at least 10% of the time during the day. For 23,000 of those acres, they would be audible for at least half of the time during the day. These acreage totals increase by 11% to 4% for the "quiet" background conditions.

The segment from Moran Junction to the South Entrance of GTNP, which carries a great deal of wheeled-vehicle traffic unrelated to the alternatives, contributes the greatest to the

total acreage values for all three audibility categories. Since the traffic and its high level of audibility remain almost constant for all the alternatives, the magnitude of audibility effects is somewhat masked.

The second largest contributor to the "audible at all" and "audible 10% or more" categories is Jackson Lake, with its snowplanes and snowmobiles. The 50-foot noise emission level used for snowplanes was 90 dBA, higher than the regulated 86 dBA, based on data collected in 1995 and 1996. (Bowlby & Associates 1995, 1996) The effect is even more evident when noting that Jackson Lake is the fourth shortest of the twenty analyzed "road" segments; the reason is the very high noise emission level of the snowplanes. However, Jackson Lake is not a contributor to the "audible 50% or more" categories because of the relatively low number of snowplanes and snowmobiles in use.

The plowed road from Mammoth to the YNP Northeast Entrance is a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more"), which remains virtually unchanged across all of the alternatives.

Other major contributors to the "audible at all" and "audible 10% or more" acreage are the Fishing Bridge-West Thumb and West Thumb-Flagg Ranch segments.

The other key segments for the "audible 50% or more" categories are from the YNP West Entrance to Madison and from Madison to Old Faithful.

Average sound level analysis

To give a sense of the effect of the number of oversnow or wheeled-vehicles on a road segment, and their speed and sound level, Table 73 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain. These hourly Leq values do not have the background sound level added in to them. Also, they cannot be compared against the background levels to assess audibility, since L_{eq} values represent a long-term average of both quiet and loud moments.

These hourly L_{eq} values show that the segment representing Jackson Lake (snowplanes and snowmobiles), plus the segments from the YNP West Entrance to Madison and Madison to Old Faithful (snowmobiles and snowcoaches) have the highest average sound levels at any given point along them.

Conclusion

The no action alternative impacts the soundscape of very large areas of the three park units. The sources are the snowmobiles and snowcoaches in YNP and a combination of snowplanes, snowmobiles, and wheeled-vehicles in GTNP and along the Parkway. A major portion of the impacted acreage is due to through traffic on US 26 for the road segment from Moran Junction to the sound environment of GTNP. Snowplanes and snowmobiles on Jackson Lake are also major contributors to audibility for at least 10% of

the time. Except for US 26, the only other areas with significant audibility 50% of the time or more are the segments in YNP from the West Entrance to Madison and from Madison to Old Faithful.

Table 72. Acres of park land affected by vehicle audibility.

Road Segment	Miles	With Average Background Conditions			With Quiet Background Conditions		
		Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More	Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More
1. Mammoth to Northeast Entrance	47	16,126	5,445	0	16,822	6,342	0
2. Mammoth to Norris	21	11,400	761	0	12,372	1,043	0
3. West Entrance to Madison	14	8,032	6,482	5,282	10,090	7,060	6,032
4. Madison to Norris	14	6,853	5,505	347	7,249	6,029	419
5. Norris to Canyon Village	12	5,443	3,955	0	5,683	4,420	0
6. Canyon Village to Fishing Bridge	16	9,999	6,559	0	11,173	7,426	166
7. Fishing Bridge to East Entrance	27	10,760	1,381	0	11,762	1,582	0
8. Fishing Bridge to West Thumb	21	15,645	9,490	0	17,785	10,884	0
9. Madison to Old Faithful	16	8,781	7,583	5,546	11,064	8,324	6,604
10. Old Faithful to West Thumb	17	7,713	6,057	0	8,053	6,643	0
11. West Thumb to Flagg Ranch	24	12,716	8,781	671	13,577	9,884	944
12. Grassy Lake Road	7.6	3,033	0	0	3,303	0	0
13. Flagg Ranch to Colter Bay	15.6	7,706	3,225	0	8,344	3,574	0
14. Colter Bay to Moran Junction	10.2	4,631	2,434	0	5,019	2,669	0
15. Moran Junction to East Entrance	2	1,225	755	489	1,319	866	534
16. Moran Junction to South Entrance	26	21,714	14,536	11,123	23,842	16,922	11,825
17. Teton Park Road	15	7,805	0	0	8,512	0	0
18. Moose-Wilson Road	2.5	1,007	0	0	1,053	0	0
19. Antelope Flats Snowmobile Route	--	No Veh.[†]	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	9.7	20,540	11,649	0	23,655	13,706	0
TOTAL		181,127	94,599	23,459	200,676	107,373	26,525

[†]No Veh. = No Vehicles

Table 73. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative A.

Road Segment	L_{eq} at Distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	44	4	42	0
3. West Entrance to Madison	56	16	54	8
4. Madison to Norris	53	13	51	5
5. Norris to Canyon Village	51	12	50	4
6. Canyon Village to Fishing Bridge	50	10	49	2
7. Fishing Bridge to East Entrance	44	4	43	0
8. Fishing Bridge to West Thumb	50	10	48	2
9. Madison to Old Faithful	56	16	54	8
10. Old Faithful to West Thumb	52	12	50	4
11. West Thumb to Flagg Ranch	51	11	50	3
12. Grassy Lake Road	42	2	41	0
13. Flagg Ranch to Colter Bay	44	7	42	0
14. Colter Bay to Moran Junction	44	9	43	1
15. Moran Junction to East Entrance	47	13	45	5
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	39	0	37	0
18. Moose-Wilson Road	34	0	32	0
19. Antelope Flats Snowmobile Route	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	58	12	56	4

Effects on Cultural Resources

Because this alternative reflects current use and management practices in the three parks, there would be no new direct or indirect impacts to cultural resources. Ongoing cultural resource management activities would continue to be directed toward the long-term preservation of cultural resources.

Conclusion

The protection, preservation, and interpretation of cultural resources would follow existing trends and, with appropriate mitigation, there would be no adverse impacts to such resources.

Effects on Visitor Access and Circulation

Access

How visitors currently arrive at the park, the activities they participate in, and the facilities available to accommodate varying modes of transportation are described in

Chapter III. All facilities, activity use levels, modes of transportation, and circulation patterns would remain the same. No changes are assumed in alternative A. The following table provides baseline winter-use levels by activity at multiple facilities and destination areas within the park units.

Table 74. Existing winter use visitation by facility or destination area.

Park / Facility	Snowmobile	Cross-Country Skiing / Snowshoe	Snowcoach Tours	Snowplanes	Wheeled-Vehicles
Yellowstone National Park					
North Entrance	None	None	None	N/A	Moderate
Northeast Entrance	None	Light	None	N/A	Moderate
East Entrance	Light	Light	None	N/A	None
South Entrance	Moderate	None	Moderate	N/A	None
West Entrance	High	Light	High	N/A	None
Mammoth	Light	High	Moderate	N/A	Moderate
Tower-Roosevelt	None	High	None	N/A	Moderate
Canyon Village	Moderate	Moderate	Moderate	N/A	None
Fishing Bridge	Moderate	Light	Light	N/A	None
Lake Village	Moderate	Light	Light	N/A	None
Bridge Bay	Moderate	Light	Light	N/A	None
West Thumb	Moderate	Light	Moderate	N/A	None
Grant Village	Moderate	Light	Moderate	N/A	None
Old Faithful	High	High	High	N/A	None
Madison	High	Light	High	N/A	None
Norris	Moderate	Light	Moderate	N/A	None
Grand Teton National Park / JDR Memorial Parkway					
Moran Entrance	Moderate	None	None	N/A	High
South Entrance	None	None	None	N/A	High
Moose-Wilson Road	Light	Moderate	None	N/A	Light
Flagg Ranch	High	Moderate	Moderate	N/A	Moderate
Colter Bay	Moderate	Moderate	None	High	High
Signal Mountain	Moderate	Moderate	N/A	Light	Moderate
Jenny Lake	Light	High	N/A	N/A	N/A
Moose Visitor Center	None	Light	N/A	N/A	Moderate
Triangle Ranch	Light	None	N/A	N/A	None

The following table shows current use on all road segments of the three park units in terms of average daily use based on the peak use months of January and February. See Appendix J and the *Methods and Assumptions* section earlier in Chapter IV for more information on how this usage was determined. Appendix J also contains similar tables

that show the number of vehicle-miles that would be traveled on an average daily basis, for each alternative scenario.

Table 75. Alternative A current motorized use.

Road Segment	*Average Daily Use January-February*			
	Autos	**Buses/Vans**	**Snowcoaches**	**Snowmobiles**
Mammoth to Northeast Entrance	61	4.2	0	0
Mammoth to Norris	0	0	3.3	30.5
West Entrance to Madison	0	0	9.1	554.2
Madison to Norris	0	0	5.2	247.0
Norris to Canyon Village	0	0	3.9	184.5
Canyon Village to Fishing Bridge	0	0	3.1	148.1
Fishing Bridge to East Entrance	0	0	0	36.4
Fishing Bridge to West Thumb	0	0	2.6	125.1
Madison to Old Faithful	0	0	10.3	488.6
Old Faithful to West Thumb	0	0	4.3	209.4
West Thumb to Flagg Ranch	0	0	4.3	175.8
Grassy Lake Road	0	0	0	24.2
Flagg Ranch to Colter Bay	86	9.5	0	24.3
Colter Bay to Moran Junction	192	10	0	24.3
Moran Junction to East Entrance	562	29	0	24.3
Moran Junction to South Entrance	773	39	0	0
Teton Park Road	0	0	0	10.4
Moose-Wilson Road	5	0	0	3
Antelope Flats Snowmobile Route	0	0	0	0

Concession Services

In the *Affected Environment* section under the main heading of *Visitor Access and Circulation* there is a discussion relevant to concessions offered in the parks, titled “Park Facilities and Winter Destination Areas.” Within this discussion are the subtopics of “lodging,” “parking,” and “other winter services and facilities.” In alternative A, under current management, the concession related facilities and services noted in the *Affected Environment* would remain the same. It should be noted that concession plans and contracts provide for some management flexibility over time to deal with changing circumstances, needs and markets. Even under current management direction, changes would be expected to occur in concessions operations.

Conclusion

All facilities, modes of transportation, and circulation patterns and use trends would remain the same as described in Chapter III, in the *Affected Environment* section relating to access.

Effects on Visitor Experience

The amount and type of winter visitor opportunities offered in the parks under the no action alternative are provided in Table 76 and Table 77.

Table 76. YNP visitor opportunities.

Opportunity	Miles or Areas	Length of Season
Oversnow motorized route	184	Mid-December to Mid-March
Oversnow motorized route — snowcoach	158.6.	Mid-December to Mid-March
Oversnow motorized trail	0	Mid-December to Mid-March
Plowed route	76	Mid-December to Mid-March
Groomed nonmotorized	37	Mid-December to Mid-March
Warming huts	6	Mid-December to Mid-March
Backcountry	2.2 million ac	Contingent on snowfall in northern portion of park

Table 77. GTNP and the Parkway visitor opportunities.

Opportunity	Miles or Areas	Length of Season
Oversnow groomed motorized route	2.1	December to April†
Oversnow groomed motorized route –snowcoach	0	December to April†
Oversnow groomed motorized trail	33.9	December to April†
Plowed road	100.1	December to April†
Ungroomed motorized trail or area	35.6 and Jackson Lake	
Groomed nonmotorized	0.	December to April†
Ungroomed nonmotorized trail or area	26.4	
Warming huts/Interpretive centers	2	December to April†

†Variable, dependent on snow conditions

Visitor Experience and Satisfaction

In alternative A, the various types of visitor experience and levels of satisfaction would remain as introduced in the *Affected Environment* section. The criteria listed below were defined by visitor responses to various surveys of winter visitors in the three park units.

Opportunities to View Wildlife. Most winter visitors rate wildlife viewing as a primary or important reason for visiting the parks. Most visitors are generally satisfied with the amount of wildlife viewing opportunities currently available. One of the top three reasons for visiting YNP cited by Borrie et al. (1999) was to view bison.

Opportunities to View Scenery. Most winter visitors to YNP and GTNP (Littlejohn 1996; Borrie et al. 1999) rate viewing scenery as a primary reason for their visit. Visitors indicated that they were for the most part "totally" satisfied with the quality of scenery in the parks.

The Safe Behavior of Others. Snowmobile and skiers rate this factor as important and indicate that it has an influence on the enjoyment of their visit. Many visitors indicate that the dual use of trails and areas for both snowmobiling and skiing contributes to the perception of an unsafe environment. Under the no action alternative, the experience of visitors would continue to be impacted.

Quality of the Groomed Surface. More than 80% of winter visitors rate the quality of the road surface as very important. The groomed surface from West Entrance to Old Faithful is frequently very rough and the quality of snow cover is poor. The CDST oversnow surface is frequently in poor condition, as is the Grassy Lake Road. Under the no action alternative these conditions would continue.

The Availability of Access to Winter Activities or Experiences. Nearly all respondents to a recent survey (Borrie et al. 1999) supported oversnow mechanized access. More than 90% of winter visitors surveyed did not support plowed roads and snowcoach-only travel. Most winter visitors valued highly the winter experience in the parks and felt it was a special and unique experience. Winter respondents to the 1998-99 winter visitor survey (Duffield et al. 2000a) also favored access to the parks by snowmobile. Respondents to the summer (Duffield et al. 2000b) and telephone surveys (Duffield et al. 2000c) were more evenly divided between support for groomed roads for snowmobiles and support for groomed access for snowcoaches. Plowed access also received very low support from the summer and telephone survey respondents. Similarly, in a count of public comments supporting various alternatives in the DEIS, there was an even split between numbers of letters supporting groomed access for snowmobiles (44%) and those supporting groomed access for snowcoaches only (45%). Very little support was indicated for the proposal to plow the West Yellowstone to Old Faithful road.

Availability of Information. Surveyed winter visitors indicate that the availability of safety information is very important. Accurate and readily available information about safe travel practices and winter conditions is one of the suggested management actions that received a high level of support from most respondents.

Quiet and Solitude. Most survey respondents felt that natural quiet and solitude was important to the quality of their park visit. A recent study indicates that respondents

ranked experiencing tranquility and peace and quiet and getting away from crowds as highly important (Borrie et al. 1999). Although an important value, many visitors responded that they were somewhat dissatisfied with their ability to experience quiet and solitude. Opportunities for quiet would continue to be minimal over 50% of the time along the road from West Yellowstone to Old Faithful and 10% of the time near Jackson Lake and along US 26 from Moran Junction to the South Entrance to Yellowstone.

Clean Air. Clean air was important to most visitors (Littlejohn 1996). Surveyed visitors indicated a high level of support for management actions requiring clean and quiet snowmobiles (Duffield et al. 2000c; Borrie et al. 1999). Snowmachine emissions on high use days are often visible along the road corridors and at staging areas, particularly at Old Faithful, near the West Entrance, and at Flagg Ranch near the South Entrance of YNP.

Conclusion

Visitor experience trends in YNP, GTNP, and the Parkway under the no action alternative would continue. Little or no operational change would occur under this alternative resulting in a negligible short-term effect in the range of experiences offered. Visitation would be influenced by the method of transportation available to visitors. Incremental increases in visitation would have a short-term negligible effect on the satisfaction of the current winter visitor.

Encounters with park wildlife and scenery would continue to be primary attractions. The overall satisfaction of winter visitors would remain high. Current levels of snowmobile emissions and sound levels would continue to detract from the winter experience for many visitors resulting in direct short-term major impacts on visitor experience. The perceived unsafe behavior of others and the occurrence of visitor conflicts would continue to have a direct short-term moderate adverse effect on the experience of some users.

IMPACTS OF IMPLEMENTING ALTERNATIVE B

Effects on the Socioeconomic Environment

GYA Regional Economy. Alternative B includes a number of provisions for relatively minor changes in management and grooming of trails within YNP and GTNP. Most of these changes are unlikely to impact visitor decisions on whether or not to visit the parks for recreation. One proposed management change, however, has the potential to substantially impact visitation levels to the GYA and, therefore, visitor expenditures and the overall level of economic activity within the GYA.

Alternative B contains a proposal to plow the road from West Yellowstone to Madison Junction to Old Faithful. The 1999 GYA winter visitor survey asked respondents how their visitation would be affected if this road segment were plowed and open for car and bus travel only. Based on the responses to this survey question, visitation to the GYA by winter visitors who live outside of the five-counties would be reduced by 18.4% if the road from West Yellowstone to Old Faithful were plowed and open only for car and bus

travel. Park visitors who reside outside of the five-county GYA made up 85.9% of total sampled visitors. This estimated reduction in visitation is a net change, which takes into consideration the responses of those current winter visitors who said they would visit more often if the change occurred. Also considered in the calculation were those respondents who said they would visit the same, but would shift their use to other areas of the GYA (for example, from park lands to national forest lands).

If 18.4% of the non-GYA resident visitors decided not to recreate within the five counties because of the plowing of the West Yellowstone to Old Faithful road, the local economy would lose the local-area expenditures these potential visitors would have made.

Using the winter survey responses and an IMPLAN input/output model, it is estimated that total economic output in the five-county GYA area would be reduced by $13.2 million under alternative B. In addition it is estimated that 312 jobs within the five counties would be lost due to reduced nonresident expenditures in the area.

While $13.2 million is a negligible to minor impact on the overall $5.7 billion economic output of the five-county area, this impact likely would be concentrated in small communities such as West Yellowstone. Currently about 50% of winter visitors to the parks enter through the West Entrance. The winter economy of West Yellowstone, Montana is centered around tourists who have come to the area to recreate in the park as well as on surrounding national forest lands. Because of the small size of the West Yellowstone economy, its relatively large share of the park's snowmobile visitors, and its proximity to the affected road segment, it can be assumed that the town will bear a disproportionately large share of the nonresident expenditure reductions.

The town of West Yellowstone levies a local option tax targeted at tourist spending. Tax records show that for the period 1989-1999, tourist expenditures have been growing at a 10% annual rate. In addition tourist spending in the winter months accounts for about 25% of year-round tourist spending in the town. Given the relative size of the West Yellowstone winter economy (relative to year-round totals) and the recent growth trends for tourist spending, the estimated visitation reductions associated with alternative B would likely have a moderate to major short-term negative impact on the town's winter economy, but a minor impact on the year-round economy of the town.

The estimates of reductions in GYA visitation and nonresident expenditures are based on responses to a survey of current winter visitors. The estimated reductions in local-area spending could be lessened if users chose to utilize the new opportunity to access Old Faithful via a shuttle bus. Some shift in use patterns would be expected as visitors become aware of the wheeled-vehicle access opportunities. The shift in visitation should be accompanied by a shift in businesses to support these users. The extent that new users from outside the GYA would be attracted to the area because of the alternative B plowing action is not known at this time.

The possible effects of alternative B on visitors entering the parks from the south are not quantifiable since no specific data exists. Recent visitor surveys have focused on understanding visitor reactions to the management actions that have the likelihood to affect large numbers of visitors. For the balance of the management actions that may affect smaller numbers of visitors, qualitative statements are possible. Providing the CDST on a separate route may attract more snowmobile users to GTNP and the Parkway because the CDST may become an attraction in its own right and may provide a better experience for visitors traveling from Moran to Flagg Ranch. In addition some snowmobile users that might have traveled into YNP via the West Entrance may choose to enter the parks via Jackson. These potential increases may be offset by the closure of the Teton Park Road, which is used by about 1,100 snowmobiles per winter, to motorized use. The increases also will be tempered by the limit on parking capacity at Flagg Ranch and the relatively long travel distance from Jackson to Flagg Ranch and from Flagg Ranch to destinations in YNP. These changes in use patterns may result in a minor increase in use in GTNP and the Parkway and, therefore, a minor increase in visitor expenditures.

Three-State Regional Economy. Overall, 65.5% of winter visitors in the GYA winter visitor survey came from outside the three-state area of Montana, Idaho, and Wyoming. Responses from these nonresident winter visitors indicate that there would be a reduction of 18.6% of winter trips to the three-state area under the alternative B plowing proposal.

A loss of the regional expenditures by these nonresidents would lead to an overall reduction of $14.4 million in total economic output and 351 jobs in the three-state area. This is a negligible negative impact in the context of the regional three-state economy. This estimated reduction would be reduced to the extent that nonresidents would choose to recreate at other locations within the three-state region instead of in the GYA. The extent of any such substitution behavior is unknown.

Minority and Low-Income Populations. One of the stated actions under alternative B is to "provide affordable access through the addition of wheeled-vehicle access to the park's interior." Currently, mechanized access to Old Faithful from West Yellowstone can be accomplished using only snowmobile or snowcoach. For visitors without personal snowmobiles, the cost of renting a snowmobile to access Old Faithful and the remaining park trails is about $100 per day. The current cost of riding a snowcoach into Old Faithful from West Yellowstone is about $85. Alternative B proposes an alternative mode of mechanized access: buses and private automobiles. It is anticipated that the shuttle bus would be offered at a relatively low cost of $30 to $40. The estimated reduced cost of accessing Old Faithful using a shuttle bus compared to renting a snowmobile or using a snowcoach is about $70 per person.

Trip expenditures per person to the parks in the GYA vary significantly between those visitors who report having the lowest household income and those who report having the highest. Winter survey respondents who reported incomes below $15,000 per year spent

an average of $329 per person on their 1999 winter trip. Those respondents reporting incomes of $150,000 and above reported spending $1,150 per person on their trips.

This is a minor to moderate beneficial impact. However, it is not clear that plowing the road would actually change the mix of lower, middle, and higher income visitors to the parks. Summer visitors do not face the high costs of snowmobile rental or snowcoach use, yet the income distribution of summer and winter visitors to YNP is quite similar. The share of the total visitor costs that can be affected by park policy is relatively low.

If the cost of accessing Old Faithful from West Yellowstone was reduced by $70 per person, winter visitors with household incomes under $15,000 per year would save about 21% in trip costs, as opposed to a 6% decrease in trip costs for visitors with incomes over $150,000.

Social Values. In anticipation of the inclusion of a number of road management options in the EIS alternatives, the winter visitor survey asked respondents what was their preferred means of access from West Yellowstone to Old Faithful in the winter months. For the entire sample of park visitors, 56.6% preferred the existing policy of grooming for snowmobile use. A total of 13.1% preferred plowing the road and grooming a parallel route for snowmobile use. A total of 6.5% chose closing the route to snowmobiles and allowing ski or snowshoe use only. Another, 19.7% chose to allow snowcoach, ski, and snowshoe travel only on this route. The least preferred option was the alternative B proposed action of plowing the road without any parallel trail for snowmobile use, which was supported by 4.2% of respondents.

Two additional questions on winter travel route management within the park were asked on the winter visitor survey. These questions were asked in the context of the impact winter travel within the park has on bison management. Among park visitors, 52.1% favored the current bison and road management policies that allow winter access for oversnow vehicles and largely regulate bison populations and movements at park boundaries. Another 23.6% favored closing motorized winter access to the park by ceasing to groom park roads from West Yellowstone to Mammoth to better allow natural forces such as weather, nutrition, and winterkill to regulate bison populations. The remaining 24.2% of respondents said they were not sure which policy they preferred.

When the winter respondents were asked the same question again with the addition of a choice for plowing the road from West Yellowstone to Old Faithful, responses were distributed in the following way: 55.3% favored the existing policy; 23% favored closing motorized winter access, 4.7% favored plowing the road from West Yellowstone to Old Faithful, and 17.1% were not sure which policy they preferred.

Responses to these three questions show a consistent picture of very low support among current winter visitors to the GYA for the major management change contained in alternative B — plowing the road from West Yellowstone to Old Faithful.

Responses to the YNP summer visitor survey and the national telephone survey were also consistent in showing very low support for the alternative B road plowing option (see Chapter III).

Nonmarket Values. The proposed alternative B actions would potentially impact nonmarket values of winter visitors in several ways. The estimated reduction in current winter user visitation resulting from the plowing of the West Yellowstone to Old Faithful road would impact total nonmarket trip values. The proposed clean and quiet snowmobile regulations for winter 2008-2009 would impact the nonmarket values that current snowmobile users place on a cleaner, quieter means of snowmobiling in the park. Finally, the plowing of the West Yellowstone to Old Faithful road segment would impact the nonmarket value associated with having this type of auto and bus access to the park.

The nonmarket value of a trip to the parks of the GYA, based on the winter visitor survey, is $91. It is estimated that park visitation would be reduced by 18.4% resulting from the plowing of the road. Based on current winter visitation levels, a 18.4% reduction in visitation would translate into a $1.5 million reduction in the aggregate nonmarket value of winter trips to the parks. This is a moderate negative impact.

Respondents to the winter survey who rented a snowmobile on their trip were asked if they would be willing to pay a higher rental fee to rent a snowmobile that was as clean and quiet running as a typical new car. The median willingness to pay to rent a clean, quiet machine was an additional $46 per day above the current cost of renting the machine. To the extent that clean and quiet snowmobiles would be more expensive to rent, this $46 net economic value would be reduced.

In the 1999 winter user survey, 41.8% of respondents (including non-snowmobiling visitors) reported renting a snowmobile on their park trip. Based on this percentage of rentals, if only clean, quiet snowmobiles were available and exclusively rented within the park today, visitors who rent snowmobiles within the park would realize an increase in aggregate net economic value of $1.7 million. To the extent that the rental price of a clean, quiet machine is more than current rental rates, this aggregate value will be reduced. If the rental cost of a clean and quiet machine is $46 more per day than current rental rates, the estimated net economic value to renters will be reduced to near zero. This is a moderate beneficial impact relative to the total value of a current trip.

A final source of changes in net economic value of a trip to the parks of the GYA is associated with the proposed plowing of the West Yellowstone to Old Faithful road. Winter visitors for whom YNP was a destination on their trip were asked if they would pay an additional fee to cover the cost of plowing the road from West Yellowstone to Old Faithful. The median willingness to pay for winter car and bus access to Old Faithful was estimated to be $6 per person. Based on this estimate, the estimated net economic value of the road access to the park would be $440,000. This is a minor positive impact for those who would continue to visit this park.

Both the estimates for net economic value of clean quiet snowmobiles and for road access to the park take into consideration the estimated reduction in visitation to the park that would occur under this alternative due to the plowing activities. These estimates are based on reduced use by current visitors.

Conclusion

The alternative B road plowing actions would have a negligible to minor impact on the five-county and three-state economies through reduced visitation and nonresident visitor expenditures. These expenditure reductions may be a moderate negative impact on small communities adjacent to the park. The alternative B road plowing actions also would have a moderate negative impact on total current trip nonmarket visitor benefits (through reduced visitation), and a minor positive impact on nonmarket benefits through improved winter access to Old Faithful. Snowmobile renters in the parks would see a moderate benefit from requirements for clean and quiet machines within the park in future years. Low-income visitors could realize a minor to moderate benefit from the alternative B actions, which would make access to the park more affordable.

Air Quality and Public Health

In this alternative, snowmobiles would no longer enter YNP at the West Entrance and travel to Old Faithful. These snowmobiles and snowcoaches would be displaced by wheeled-vehicles, including mass transit vans that would operate on a plowed road from the West Entrance to Old Faithful. In addition by winter 2008-2009, oversnow vehicle emission rates would be 40% of the baseline CO emission rate, 75% of the baseline PM_{10} rate, and 70% of the baseline hydrocarbon emission rate. Table 78, Table 79, and Table 80 summarize the results of CO modeling for six locations in the three parks for alternative B. Table 78 and Table 79 show the predicted maximum 1-hour average CO concentrations and the calculated maximum 8-hour average CO concentrations, respectively. The percent contribution of each vehicle type, including snow plows, to the maximum CO concentrations also is provided in Table 80 for the six locations. Table 81 and Table 82 provide corresponding model results for PM_{10} for the same locations and conditions as those for CO.

Visibility

The visibility assessment indicates that under this alternative, vehicular emissions would not cause any perceptible visibility impairment in the vicinity of the West Entrance or along the roadways. Perceptible visibility degradation could occur in the vicinity of Old Faithful and Flagg Ranch when vehicles idle for extended periods.

Conclusion

As noted in Table 78, Table 79, and Table 81, the model predicts major beneficial impacts relative to alternative A at the West Entrance and along the West Entrance to Madison roadway, for the peak traffic hour on high winter use days. Both CO and PM_{10} concentrations would be reduced by more than 85%. Negligible CO reductions are

predicted for alternative B at the staging areas, and a minor adverse impact on CO concentration is predicted along the Flagg Ranch to Colter Bay roadway due to minor estimated increases in wheeled-vehicles using this roadway. For PM_{10}, a moderate beneficial impact would be realized at the Old Faithful staging area, but a minor adverse impact is predicted for the Flagg Ranch staging area.

Table 78. Maximum 1-hour average CO concentrations for alternative B.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	3.30	6.30	88.7
West Entrance to Madison Roadway	0.70	3.70	94.1
Old Faithful Staging Area	.88	3.88	31.3
Flagg Ranch Staging Area	1.19	4.19	30.8
Flagg Ranch to Colter Bay Roadway	1.00	4.00	9.1
Mammoth to NE Entrance Roadway	0.30	3.30	0.0

Table 79. Maximum 8-hour average CO concentrations for alternative B.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	1.55**	2.96**	88.7
West Entrance to Madison Roadway	0.33**	1.74**	94.1
Old Faithful Staging Area	0.15	1.55	31.3
Flagg Ranch Staging Area	0.20	1.60	30.8
Flagg Ranch to Colter Bay Roadway	0.47**	1.88**	9.1
Mammoth to NE Entrance Roadway	0.14**	1.55**	0

** Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 80. Vehicle contribution to CO concentrations for alternative B.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	0	0	12.5	23.4	1.0	0.6	62.5
West Entrance to Madison Roadway	0	0	10.1	24.2	0.6	0.4	64.6
Old Faithful Staging Area	62.1	1.2	4.4	8.7	0.1	0.1	23.4
Flagg Ranch Staging Area	69.3	1.2	8.9	17.6	0.1	0.1	2.9
Flagg Ranch to Colter Bay Roadway	49.8	0	13.3	31.1	0.4	0.1	5.3
Mammoth to NE Entrance Roadway	0	0	26.5	66.9	0.5	0	6.1

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Table 81. Maximum 24-hour average PM_{10} concentrations for alternative B.

Location	24-hr Maximum Concentration (w/o Background) ($\mu g/m^3$)	24-hr Maximum Concentration (w/Background) ($\mu g/m^3$)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	0.63**	23.63	98.6
West Entrance to Madison Roadway	0.63**	23.63	94.1
Old Faithful Staging Area	0.12	5.12	81.3
Flagg Ranch Staging Area	0.18	5.18	72.2
Flagg Ranch to Colter Bay Roadway	0.63**	5.63	33.3
Mammoth to NE Entrance Roadway	0.32**	5.32	0

** Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 82. Vehicle contribution to PM_{10} concentrations for alternative B.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	0	0	3.5	6.7	44.3	27.5	18.0
West Entrance to Madison Roadway	0	0	6.8	13.4	28.2	15.7	35.8
Old Faithful Staging Area	97.0	0	0	0	1.5	1.4	0
Flagg Ranch Staging Area	98.3	0	0	0	1.1	0.6	0
Flagg Ranch to Colter Bay Roadway	36.3	0	11.0	21.3	21.4	6.4	3.6
Mammoth to NE Entrance Roadway	0	0	22.5	46.6	26.7	0	4.2

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Effects on Public Safety

Alternative B proposes several actions that would reduce accident potential and improve safety conditions in the parks. The addition of an aggressive safety and enforcement program would provide moderate improvements to the safety of all three park units. Many visitors currently express concern over the unsafe behavior of other winter visitors, particularly those riding snowmobiles (Friemund 1996). Novice or rental snowmobile riders accounted for over 85% of all snowmobile accidents (1995-98). An aggressive safety program, particularly one operated in cooperation with gateway communities, would allow park personnel to reach more novice snowmobile riders and thereby reduce the potential for snowmachine accidents.

The implementation of nighttime (11 P.M. to 5 A.M.) travel restrictions in the parks would eliminate motor vehicle incidents during this time. The effect on public safety from this action would be negligible because less than 1% of recorded motor vehicle accidents have occurred between these hours.

Current road conditions are cited as contributing factors in about 16% of snowmobile accidents in YNP. Improved road and trail conditions would be expected to decrease accident rates. Eliminating travel on a freshly groomed route allows the surface to harden, improving its quality. Since the majority of road grooming in YNP is performed in the early evening, late night closures would have a negligible effect on the current quality of the groomed surface.

In YNP alternative B proposes plowing the road segments between West Yellowstone and Old Faithful and would implement a shuttle bus system as the primary mode of visitor access on this route. This action would provide moderate benefits to public safety because shuttle bus drivers would have greater familiarity with winter driving conditions, and local wildlife movements and the overall numbers of vehicle miles traveled per day on these road segments would be greatly reduced. However, conflict between wheeled-vehicles would be anticipated, and the potential for vehicle-animal collisions would be greater under this alternative than under the no action alternative (see Chapter III, *Motor Vehicle Accidents — YNP*).

Depending on weather conditions, the plowed road from the West Entrance to Old Faithful would greatly improve ambulance response times to Madison and Old Faithful.

Relocating the CDST in GTNP to a new pathway between Moran and Flagg Ranch would eliminate the potential for inter-modal conflicts along that stretch of road and alleviate expressed concern about safety regarding this arrangement. Phasing out snowmobile use on Jackson Lake would eliminate the potential there for snowmobile-related incidents. Closing the Teton Park Road to snowmobiles would eliminate the potential for accidents involving co-located skiers and snowmobiles.

Conclusion

Overall, implementation of this alternative would result in moderate beneficial improvements to public safety in YNP primarily due to the implementation of a mass transit system between the West Entrance and Old Faithful, an aggressive safety information and enforcement program, and a shorter response time for EMS to the Madison and Old Faithful areas. These improvements would affect employees and visitors.

Implementation of this alternative would result in moderate beneficial improvements to public safety in GTNP due to increased safety information and an enforcement program, reduction of inter-modal conflicts, separation of uses, and elimination of snowmobile conflicts on Jackson Lake. These impacts would affect employees and visitors.

Effects on Geothermal Features

In alternative B, areas of winter visitor access are the same as described in alternative A, The effects of winter access to geothermal features are similar to those described in alternative A with the following exceptions.

The additional public awareness that would result from increased interpretive opportunities would provide beneficial improvements to the protection of geothermal resources.

The longer winter visitor season (from early December through mid-March) on the road from West Yellowstone to Madison and Madison to Old Faithful would increase the number of visitors in the geothermal basins along the Madison to Old Faithful road segment and at Old Faithful. This increased use and access would cause a corresponding increase in the likelihood of adverse impacts on the geothermal resources in this area.

Plowing the road from Old Faithful to West Yellowstone would afford park managers some discretion when identifying the location of plowed pullouts and shuttle bus stops. This action would provide a minor amount of additional protection to geothermal resources along these road segments. Similarly, backcountry travel restrictions may indirectly improve the protection of geothermal features. All backcountry travel under this alternative would be restricted to designated trails in wildlife winter range, which includes geothermal areas. This restriction would benefit geothermal features since off-trail travel would not be allowed and managers would only designate winter travel routes that are away from sensitive areas.

If the adaptive management provisions (research and monitoring) of this alternative indicate that winter visitor use is causing direct long-term impacts to geothermal features, then those impacts must be mitigated or the features would be closed to visitors. The adaptive management provisions of this alternative provide major long-term benefits to the protection of geothermal resources.

Conclusion

An increase in winter visitation would result in minor adverse impacts on geothermal features near roads, staging, and destination areas. Minor adverse impacts may occur in other geothermal areas accessed by groomed roads and nonmotorized trails. These impacts may be long term. Some mitigation of the described impacts would occur through increased interpretation and winter backcountry-use restrictions. All geothermal features would be protected through the monitoring and scientific studies provisions of this alternative. If adverse impacts occur that cannot be mitigated, the geothermal feature or resource would be closed to visitor use. The short-term impacts on geothermal resources would be minor and adverse. Although some long-term adverse impacts may occur on individual features, the overall protection to these resources provided by this alternative is moderate to major and beneficial.

Water and Aquatic Resources

The potential for risk of pollutants, as described in alternative A, entering surface and subsurface waters would increase as the number of snowmobiles increase along the Canyon Village to Fishing Bridge “high” risk road segment. The risk to water quality

would decrease along the Madison to Norris and Madison to Old Faithful "high" risk road segments with the decrease or prohibition of snowmobiles on those segments.

The potential for risk of pollutants entering surface water from "medium" risk road segments would increase on the Mammoth to Norris, Fishing Bridge to East Entrance, Fishing Bridge to West Thumb, Old Faithful to West Thumb, and West Thumb to Flagg Ranch segments as the number of snowmobiles increased.

The potential for risk of pollutants entering surface water from the "low" risk Norris to Canyon and Teton Park Road segments would decrease with the decrease or prohibition of snowmobiles on that segment.

There would be no change along the remaining road segments.

Table 83[34]. Snowmachines and associated risk levels for alternative B.

Road Segment	Risk ± Rating	Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. A*		Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. B*	
		SM	SC	SM	SC
Mammoth to Norris	Medium	641	69	1176	63
West Entrance to Madison	Medium	7759	127	0	0
Madison to Norris	High	3458	73	588	70
Norris to Canyon Village	Low	2214	47	672	48
Canyon Village to Fishing Bridge	High	2370	50	3872	48
Fishing Bridge to East Entrance	Medium	983	0	1809	0
Fishing Bridge to West Thumb	Medium	2627	55	5208	63
Madison to Old Faithful	High	7818	165	0	0
Old Faithful to West Thumb	Medium	3560	73	5746	68
West Thumb to Flagg Ranch	Medium	4219	103	7728	96
Grassy Lake Road	High	184	0	200	0
Flagg Ranch to Colter Bay	Low	379	0	400	0
Colter Bay to Moran Junction	High	248	0	250	0
Moran Junction to East Entrance	Medium	49	0	50	0
Teton Park Road	Low	156	0	0	0
Moose-Wilson Road	Low	6	0	6	0

[34] *SM = Snowmobile, SC = Snowcoach; The source of pollutants is emissions from snowmobiles, which produce (conservatively) ten times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce fewer emissions then single snowmobiles.
±High = within 100 meters of aquatic system on 76% to 100% of the road segment; Medium = within 100 on 51% to 75% of the road segment; Low risk segments are within 100 meters of rivers less than 50%.

Conclusion

Deposition into snowpack would continue to occur from 2-stroke engine emissions along groomed park roads in YNP and GTNP. The effect of this deposition on water quality is undetermined but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. It is possible that accumulations of pollutants in aquatic systems may have adverse impacts on wetlands and aquatic resources downstream from high-risk road segments. Oversnow vehicle use in this alternative involves localized high risk to surface water quality, but reduces oversnow vehicle-miles traveled along high risk road segments in the three park units by about 65%. Snowmobile and snowplane use on Jackson Lake would continue the risk of moderate to major adverse impacts on water quality in that water body. The phasing out of snowmobile use on Jackson Lake would in time reduce the sources of pollution by half. Minor short-term water quality and wetland impacts would occur along the eastern side of US 89/287 as a result of new pathway construction.

Mitigation

The new year-round pathway would be designed and sited to minimize impacts to all park resources including wildlife, vegetation, and wetlands. Any impacts to wetlands would be minimized and mitigated in accordance with NPS Wetland Guidelines. Any needed bridges would be designed to complement, not impact, floodplains in accordance with NPS Floodplain Management Guidelines. The use of bio-based fuels by the NPS and the availability of fuels in gateway communities may result in a minor decrease in pollutant deposition into snow. Best management practices would be utilized during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation. The release of snowpack contaminants into surface water could be mitigated by disconnecting snowmelt drainages from trails used by oversnow vehicles. Any new or reconstructed winter-use sanitary facilities would be constructed in locations and using advanced technologies that would protect water resources. A focused program of monitoring would reduce the uncertainty of impacts from oversnow vehicles, and if necessary, indicate best management practices that might be implemented.

Effects on Wildlife

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into wildlife areas that would normally be inaccessible due to deep snow. Under alternative B, YNP would groom about 160 miles of road surface for use by oversnow motorized vehicles (24 less than under alternative A) and 47 miles for nonmotorized use (10 more than under alternative A). GTNP and the Parkway would groom about 36 miles, the same as alternative A.

In YNP effects related to packed trails would be reduced relative to alternative A. Effects in GTNP would remain the same.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause injury and death to wildlife, especially in poor lighting conditions and during snowfall, and can cause displacement from preferred habitats. Under alternative B, these effects would be associated with 160 miles of groomed oversnow motorized roads in YNP (24 less than current management); GTNP would maintain 36 miles of groomed motorized routes (the same as currently) and 11 miles of ungroomed motorized routes (24 miles less than current management).

Because the use of oversnow motorized vehicles would be reduced in the parks under alternative B, overall associated effects would be reduced with the exception of the routes from Moran to Flagg Ranch and Grassy Lake Road in GTNP. The separation of the CDST from the plowed roadway would cumulatively increase collision and displacement impacts associated with the use of both oversnow and wheeled-vehicles.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, may also provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative B, the effects described above are associated with about 106 miles of plowed road in YNP, an increase of 30 miles over existing management. The road would be open to mass transit vehicles and about 40 private vehicles, with no late night traffic allowed. GTNP, including the Parkway, would continue to maintain about 100 miles of plowed road, the same as under current management.

In YNP the plowed road from West Entrance to Old Faithful would result in more snow berms, thus potentially increasing fragmentation along this segment. An increase in ungulate use of the plowed road as compared to the currently groomed road is not expected because plowed roads do not offer additional energy savings over groomed roads. The effects of plowed roads in GTNP would be the same as those described in alternative A.

All other potential impacts would be the same as stated in alternative A.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

The use of plowed roads by wheeled-vehicles may increase wildlife-vehicle collisions over current rates along the road segment from West Yellowstone to Old Faithful. The limitation on late night travel (11 P.M. to 5 A.M.) and the use of NPS-managed shuttle busses with trained drivers will help to mitigate collision impacts. According to Gunther et al. (1998) no collisions have occurred between busses and ungulates in the park.

Displacement of ungulates from preferred habitats along the West Yellowstone to Old Faithful route would be reduced relative to alternative A because vehicle numbers would be reduced, and traffic would be more predictable and less dispersed.

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative B, YNP increases nonmotorized opportunities from 37 to 47 miles of groomed nonmotorized routes, and GTNP and the Parkway increase ungroomed nonmotorized routes from 26 to 33 miles. Although the above effects may be increased due to the addition of nonmotorized routes, they are expected to be relatively minor because most with the exception of short trails in the Mammoth Hot Springs and Blacktail Plateau areas, would not be located in critical ungulate winter range.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Alternative B reduces the potential for these effects in YNP by eliminating or restricting backcountry use in winter range. Use, where permitted, would be limited to designated routes where ungulate habitat would not be impacted. Because winter range in GTNP is relatively limited and already closed to public access in several areas, no new restrictions on use in this park are proposed under this alternative.

Under alternative B, impacts associated with backcountry use in GTNP would remain the same as those under alternative A. Moderate to major adverse impacts on bighorn sheep would continue, as well as potential impacts on moose, elk, and bison on Blacktail Butte and Wolff Ridge.

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Alternative B proposes an increase in the number and size of warming huts and other day-use facilities. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate or nonexistent (e.g., Tower, Norris, Canyon). Warming huts in the vicinity of ungulate winter range important to elk, deer, and bison would potentially increase human use and consequently reduce habitat effectiveness. However, over time, the predictable nature of the recreation expected to occur in the area may allow species to habituate to the increase in human activity. The effects of these huts on ungulates would be the same for all alternatives.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow. Under alternative B, YNP would groom about 160 miles of road surface for use by oversnow motorized vehicles (24 less than under alternative A) and 47 miles for nonmotorized use (10 more than under alternative A). GTNP and the Parkway would groom about 36 miles, the same as alternative A.

In YNP effects related to packed trails would be slightly reduced from those under alternative A. Effects in GTNP would remain the same. The parks may close any area if warranted to protect federally protected species.

Effects of motorized use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. Mortality caused by collisions with snowmobiles or snowcoaches has not occurred for any of these species. Under alternative B, these effects would be associated with 160 miles of groomed oversnow motorized roads in YNP (24 less than current management); GTNP would maintain 36 miles of groomed motorized routes, the same as current management, and 11 miles of ungroomed motorized routes, 24 miles less than current management.

Because the use of oversnow motorized vehicles would be reduced in the parks under alternative B, overall associated effects would be reduced with the exception of the route from Moran to Flagg Ranch in GTNP. The separation of the CDST from the plowed roadway would cumulatively increase displacement impacts associated with the use of both oversnow and wheeled-vehicles. Canada lynx and wolves may be affected along this route.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). Similar to groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow. Under alternative B, the effects described above are associated with about 106 miles of plowed road in YNP, an increase of 30 miles over existing management. The road would be open to mass transit vehicles and about 40 private vehicles, with no late night traffic allowed. GTNP including the Parkway would continue to maintain about 100 miles of plowed road, the same as under current management.

Under alternative B, impacts related to plowed roads would slightly increase in YNP as compared to alternative A. The road from West Yellowstone to Old Faithful would be plowed and open to public access two weeks earlier under this alternative, potentially leading to an increase in human-bear interactions during the pre-breeding period. However, none of the radio-collared bears in YNP have denned along this road segment, and only about 10% of bears are still active at this time (Haroldson et al. In prep). Effects related to plowed roads in GTNP would remain the same as under current management.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those of traffic on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

Under alternative B, impacts related to plowed roads would slightly increase in YNP as compared to alternative A. The limitation on late night travel (11 PM to 5 AM) and the use of NPS-managed shuttle busses with trained drivers will help to mitigate collision impacts. In GTNP the separation of the CDST from the plowed roadway would cumulatively increase displacement impacts associated with the use of both oversnow and wheeled-vehicles. Canada lynx and wolves may be affected along this route.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative B, YNP increases nonmotorized opportunities from 37miles to 47 miles of groomed nonmotorized routes, and GTNP and the Parkway increase ungroomed nonmotorized routes from 26miles to 33 miles.

Although the above effects may be increased due to the addition of nonmotorized routes, they are expected to be negligible because most routes, with the exception of short trails in the Mammoth Hot Springs and Blacktail Plateau areas, would not be located in critical ungulate winter range, and consequently the species that prey upon ungulates or consume their carcasses would not be affected. Furthermore, when warranted, the parks may close any area where federally protected species are observed.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and federally protected wildlife species may only occur sporadically, they may cause displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Alternative B minimizes the potential for these effects in YNP by eliminating or restricting backcountry use in winter range. Use, where permitted, would be limited to designated routes where ungulate habitat would not be impacted. Because winter range in GTNP is relatively limited and already closed to public access in several areas, no new restrictions on use in this park are proposed under this alternative.

Impacts related to backcountry use under alternative B would be reduced as compared to current management in YNP. Impacts in GTNP would remain the same.

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species by the presence of human food and garbage, and can lead to human-wildlife conflicts. In addition increases in human activity

associated with the presence of support facilities may displace species sensitive to human disturbance. Alternative B proposes an increase in the number and size of warming huts and other day-use facilities. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate or nonexistent (e.g., Tower, Norris, and Canyon).

A major problem associated with human development in occupied bear habitat is the availability of food attractants. Bears that become conditioned to human foods and garbage are often the targets of management actions, including lethal control. High winter visitor use has contributed to a garbage problem in YNP as garbage that has accumulated throughout the winter may attract hungry grizzly bears in the spring. To date, YNP does not have adequate winter garbage storage facilities but will rectify this issue by constructing a winter garbage storage facility that is wildlife-proof in the Old Faithful, Grant, Lake, and Canyon areas (a feature of all alternatives). In addition under alternative B, the availability of a plowed road into the park's interior would allow for the removal of garbage, thus decreasing problems associated with habituation.

Compared to current management, impacts related displacement would be greater due to the increase in number of facilities. Specifically, huts located in thermally influenced ungulate winter range could displace ungulates, and thus affect the availability of bison and elk carcass, important spring foods for grizzly bears. Because ungulates have been known to habituate to predictable human activities any displacement would most likely be short term. In addition as stated previously, the majority of bears do not emerge from hibernation until after the winter use season at which time the Bear Management Area restrictions will be in affect to allow bears uninterrupted use of spring carcass habitats in known winter ranges. Areas of high bear use may be closed at any time according to park policy.

Species of Special Concern.

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow; inhibiting foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey; and reducing subnivian prey availability by increasing mortality of these small mammals. Under alternative B, YNP would groom about 160 miles of road surface for use by oversnow motorized vehicles (24 less than under alternative A) and 47 miles for nonmotorized use (10 more than under alternative A). GTNP and the Parkway would groom about 36 miles, the same as alternative A.

In YNP effects related to packed trails would be slightly reduced from those under alternative A. Effects in GTNP would remain the same. The parks may close any area if warranted to protect federally protected species.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts to park species of special concern are displacement from preferred

habitats and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare. In ten years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998). Under alternative B, these effects would be associated with 160 miles of groomed oversnow motorized roads in YNP, 24 miles less than current management; GTNP would maintain 36 miles of groomed motorized routes and 11 miles of ungroomed motorized routes, 24 miles less than current management.

Because the use of oversnow motorized vehicles would be reduced in the parks under alternative B, overall associated effects would be reduced with the exception of the routes from Moran to Flagg Ranch and Grassy Lake Road in GTNP. The separation of the CDST from the plowed roadway would cumulatively increase displacement impacts associated with the use of both oversnow and wheeled-vehicles.

See *Water and Aquatic Resources,* Chapter IV for an assessment of the impacts of exhaust on water quality in the parks.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative B, the effects described above are associated with about 106 miles of plowed road in YNP, an increase of 30 miles over existing management. The road would be open to mass transit vehicles and a small number of about 40 private vehicles, with no late night traffic allowed. GTNP, including the Parkway, would continue to maintain about 100 miles of plowed road, the same as under current management.

Under alternative B, impacts related to plowed roads would slightly increase in YNP as compared to alternative A. Effects related to plowed roads in GTNP would remain the same as under current management.

Effects of motorized use of plowed roads. The most likely impact to park species of special concern is displacement from preferred habitats and mortality caused by collisions.

Under alternative B, impacts related to plowed roads would slightly increase in YNP as compared to alternative A. In particular, swans that winter in open water habitats along the plowed road from the West Entrance of YNP to Old Faithful may be disturbed by the increase in wheeled-vehicle traffic along this route. In GTNP the separation of the CDST from the plowed roadway would cumulatively increase displacement impacts associated with the use of both oversnow and wheeled-vehicles.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative B, YNP increases nonmotorized opportunities from 37miles to 47 miles of groomed nonmotorized routes, and GTNP and

the Parkway increase ungroomed nonmotorized routes from 26miles to 33 miles. Although the above effects may be increased due to the addition of nonmotorized routes, they are expected to be relatively minor because most routes would not be located in areas critical to species of special concern (e.g., adjacent to open water habitats and ungulate winter ranges).

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and species of special management concern may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Alternative B minimizes the potential for these effects in YNP by eliminating or restricting backcountry use in important winter habitats (e.g., thermally influenced areas). Use, where permitted, would be limited to designated routes. Because winter habitats in GTNP are already closed to public access in several areas, no new restrictions on use in this park are proposed under this alternative.

Impacts related to backcountry use in under alternative B would be reduced as compared to current management in YNP. Impacts in GTNP would remain the same as under alternative A.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on park species of special concern are associated with increases in human activity and the subsequent disturbance and displacement of species or their prey. Alternative B proposes an increase in the number and size of warming huts and other day-use facilities. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate (e.g., Tower, Norris, and Canyon).

Compared to current management, impacts related to displacement would be greater due to the increase in number of facilities. Specifically, huts located in thermally influenced ungulate winter range could displace ungulates, and thus affect bison and elk carcass availability for wolverines, fishers, and marten. Because ungulates have been known to habituate to predictable human activities any displacement would most likely be short term. Impacts to other species of special concern would be the same as those under alternative A.

Conclusion

All effects described above and summarized in this section would be short term in nature. Effects associated with groomed roads and snowmobiles would decrease in YNP, but would remain a concern in GTNP due to the separation of the CDST from the road shoulder. Effects related to wheeled-vehicles in YNP would increase but would be mitigated through the use of mass transit and restrictions on travel in the evenings. Another important component for wildlife is the implementation of closures and

restrictions in certain backcountry wildlife winter ranges in YNP. Adaptive management may be employed to adjust management if and when impacts to wildlife are determined. Further mitigation would be afforded by an increased emphasis on visitor education and interpretive opportunities, as well as increased administrative capability.

Although impacts to populations resulting from winter recreation are neither long term nor very significant, impacts to individual members of the population can be important, leading to death either directly from collisions or continued harassment, or indirectly through management actions as a response to habituation to human presence and food. Although concerned about impacts to individuals, for the most part (with the exception of federally protected species), the NPS bases management actions on the protection of populations of native animals. For example, see NPS 77, Natural Resources Management, Chapter II.

Ungulates

- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects. Effects are reduced from alternative A in YNP and remain the same in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: 1) mortality caused by collisions –less than alternative A for YNP, greater than alternative A for GTNP due to the separation of the CDST from the road shoulder; and 2) displacement from preferred habitats less than alternative A for YNP, greater than alternative A for GTNP due to the separation of the CDST from the road shoulder.
- Effects of plowed roads on: 1) habitat fragmentation – more than alternative A for YNP, same as alternative A for GTNP; and 2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects — same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – more than alternative A for YNP, same as alternative A for GTNP; and 2) displacement from preferred habitats – less than alternative A for YNP, same as alternative A for GTNP.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – slighter greater than alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – less than alternative A for YNP, same as for GTNP. Impacts to bighorn sheep in GTNP would remain moderate to major and long term if no mitigation is applied.
- Effects of the presence and use of winter support facilities on displacement. Effects may be increased relative to alternative A because more huts are proposed.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: 1) bald eagles, grizzly bears, and wolves — same as alternative A; and 2) lynx – less than alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – less than alternative A with the exception of the CDST/plowed road segment which would be greater than alternative A; excluding the grizzly bear which, for the most part, will not be active during the winter use season.
- Effects of plowed roads on: (1) habitat fragmentation – all species, more than alternative A for YNP, same as alternative A for GTNP; and 2) animal movements – all species, no known effect.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – bald eagles and grizzly bears, more than alternative A for YNP, same as for GTNP; wolves, more than alternative A for YNP, same as for GTNP; lynx, same or more than alternative A for all parks; and 2) displacement from preferred habitats – bald eagles, more than

alternative A for YNP, no effect on grizzly bears; no known effect to date on wolves and lynx.

- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no effect on grizzly bears; no known effect to date on wolves and lynx. Effects may slightly increase relative to alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, minor, and short term on bald eagles; adverse, negligible, and short term on grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx. These effects would be less than alternative A for YNP, same as alternative A for GTNP.
- Effects of the presence and use of winter support facilities on displacement – no affect on bald eagles; adverse, negligible, and short term on grizzly bears, with mitigation; adverse, minor, and short term on wolves; no effect on lynx. Effects may be slightly increased relative to alternative A because more huts are proposed.

Species of Special Concern

- Effects of groomed roads and trails on 1) animal movements – no known effect on wolverines; adverse, negligible, and short term on fishers and martens; no effect on otters, swans, reptiles, amphibians, and fish; 2) foraging activities – adverse, negligible, short term on marten; no effect on the other species; and 3) subnivian prey availability — adverse, negligible, and short term on marten; no effect on the other species. May be a slight reduction relative to alternative A for YNP; effects would remain the same for GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect on wolverine; adverse, negligible, and short term on fishers and marten; no effect on otters, reptiles, amphibians, and fish; adverse, minor, short term on swans. May be a slight reduction relative to alternative A for YNP; effects may increase in GTNP due to removing the CDST from the road shoulder.
- Effects of plowed roads on animal movements – no known effect on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish. If effects did occur, they would increase in YNP relative to alternative A.
- Effects of motorized use of plowed roads on 1) displacement from preferred habitats – adverse, negligible, short term on wolverines, fishers, martens; no effect on otters, swans, reptiles, amphibians, and fish and 2) mortality from collisions — adverse, negligible, and short term on otters and martens; no effect to date on other species. Effects may increase relative to alternative A in YNP.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect on wolverines; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; adverse, negligible, and short term on sagebrush lizard; no effect on rubber boa, amphibians, and fish. Effects may slightly increase relative to alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible, and short term on wolverines and sagebrush lizard; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; no effect on rubber boa, amphibians, and fish. Effects decrease relative to alternative A in YNP, and may increase in GTNP.
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor, and short term on wolverines, fishers, and martens; no effect on swans, rubber boa, amphibians, and fish; no known effect on otters; adverse, minor, and short term on sagebrush lizard. Effects may be slightly increased relative to alternative A because more huts are proposed.

Mitigation

- Closures around known dens and nests would continue to be implemented.

- The monitoring and evaluation of backcountry nonmotorized use in GTNP should be enhanced and closures should be implemented as warranted.
- Ramps or pullouts for moose to exit plowed roads to reduce collisions between snowmobiles and moose along the CDST would be provided.
- Use of groomed and plowed surfaces by bison and other ungulates would continue to be monitored.
- Snow track surveys for carnivores, including lynx, on both groomed and ungroomed routes would be conducted.

Effects on Natural Soundscape

Audibility analysis — combined effects of all wheeled and oversnow vehicles

Table 84 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet," as defined in the *Assumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: (1) audible for any amount of time (labeled "audible at all"); (2) audible for 10% of the time or more; and (3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

Alternative B features plowing the road from the West Entrance of YNP to Old Faithful; use of "clean and quiet" snowmobile and snowcoach (based on a 70 dBA noise emission level at 50 feet); elimination of snowmobiles on Teton Park Road; and phasing out of snowmobiles (but not snowplanes) on Jackson Lake. This alternative also requires that all snowplanes on Jackson Lake meet the current regulated limit of 86 dBA at 50 feet.

The results for alternative B show that for the "average" background sound level, wheeled or oversnow vehicles would be audible to some degree for over 138,000 acres in the three park units. For over 59,000 of those acres, wheeled or oversnow vehicles would be audible for at least 10% of the time during the day. For over 14,000 of those acres, they would be audible for at least half of the time during the day. These acreage totals increase by 8% to 15% for the "quiet" background conditions.

The "clean and quiet" requirement results in reduced audibility acreage over all segments that carry oversnow vehicles. These reductions are less evident when looking at the totals because of large contribution from the segment from Moran Junction to the South Entrance of GTNP for all three audibility categories, acreage that remains almost constant for all of the alternatives. For example, over 75% of the acreage for the "audible 50% or more" categories is along this segment.

The other key segments for the "audible 50% or more" categories are from Fishing Bridge to West Thumb, from West Thumb to Flagg Ranch, and from Canyon Village to Fishing Bridge, although all are significantly reduced compared to the no action alternative.

The audibility acreage is greatly reduced for the West Entrance to Madison and Madison to Old Faithful segments due to the replacement of oversnow vehicles with wheeled-

vehicles on the plowed road. Likewise the, elimination of snowmobiles, on Teton Park Road reduces its audibility acreage to zero.

The plowed road from Mammoth to the Northeast Entrance is a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more"). This impact remains virtually unchanged across all the alternatives, somewhat makes the beneficial impacts of reduced sound from oversnow motorized vehicles.

Snowplanes and snowmobiles on Jackson Lake are also major contributors to the "audible at all" categories, although the acreage is greatly reduced over the no action alternative because of the sound level restrictions on both machines and the phasing out of snowmobiles.

Average Sound Level Analysis

To give a sense of the effect of the number of oversnow or wheeled-vehicles on a road segment, and their speed and sound level, Table 85 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain. These hourly L_{eq} values do not have the background sound level added in to them. Also, they cannot be compared against the background levels to assess audibility, since L_{eq} represents a long-term average of both quiet and loud moments.

The hourly L_{eq} at 100 feet is highest for the segment representing Jackson Lake, plus the segments from Canyon Village to Fishing Bridge, from Fishing Bridge to West Thumb, from Old Faithful to West Thumb, and from West Thumb to Flagg Ranch. The segments from Moran Junction to the GTNP East Entrance and to the GTNP South Entrance would have the highest L_{eq} at a distance of 4,000 feet away.

There are major 16 dB to 18 dB reductions in the L_{eq} for the West Entrance to Madison and Madison to Old Faithful segments that would be plowed.

Table 84. Acres of park land affected by vehicles audibility for alternative B.

Road Segment	Miles	With Average Background Conditions			With Quiet Background Conditions		
		Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More	Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or more
1. Mammoth to Northeast Entrance	47	16,121	5,440	0	16,816	6,337	0
2. Mammoth to Norris	21	8,383	924	0	9,069	1,014	0
3. West Entrance to Madison	14	5,302	1,396	0	5,599	1,632	0
4. Madison to Norris	14	5,203	145	0	5,538	174	0
5. Norris to Canyon Village	12	4,302	0	0	4,540	0	0
6. Canyon Village to Fishing Bridge	16	7,140	5,079	494	7,865	5,559	807
7. Fishing Bridge to East Entrance	27	8,765	1,294	0	9,655	1,416	0
8. Fishing Bridge to West Thumb	21	10,681	7,564	1,378	11,941	8,111	2,019
9. Madison to Old Faithful	16	6,205	1,707	0	6,571	1,979	0
10. Old Faithful to West Thumb	17	6,500	4,707	0	6,976	5,325	0
11. West Thumb to Flagg Ranch	24	10,249	7,105	902	11,038	8,039	998
12. Grassy Lake Road	7.6	2,203	0	0	2,414	0	0
13. Flagg Ranch to Colter Bay	15.6	7,670	2,983	0	8,328	3,279	0
14. Colter Bay to Moran Junction	10.2	4,610	2,331	0	4,959	2,535	0
15. Moran Junction to East Entrance	2	1,201	724	490	1,302	819	534
16. Moran Junction to South Entrance	26	21,714	14,812	11,293	23,842	17,207	11,996
17. Teton Park Road	15	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	2.5	807	0	0	853	0	0
19. Antelope Flats Snowmobile Route		No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	9.7	10,963	3,326	0	12,280	4,905	0
TOTAL		138,018	59,534	14,558	149,589	68,331	16,355

Conclusion

Alternative B impacts about 75% to 76% of the acreage impacted by the no action alternative, in terms of time when vehicles would be audible at all. For the 10% and 50% audibility categories as a group, the acreage drops to about 63% to 64% of that for the no action alternative. In YNP the 50% time audible acreage drops to only 23% of that for the no action alternative for average background conditions. The reasons for the reductions are the use of the 70-dBA "clean and quiet" snowmobiles and snowcoaches, the replacement of oversnow vehicles with wheeled-vehicles from West Entrance to Old Faithful, and the elimination of oversnow vehicles on Teton Park Road. In YNP the 50% time audible acreage drops to only 23% of that for the no action alternative for average background conditions. For all three audibility categories taken together, alternative B impacts the second smallest acreage after alternative D.

Table 85. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative B.

Road Segment	L_{eq} at Distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	42	3	41	0
3. West Entrance to Madison	38	6	37	0
4. Madison to Norris	42	2	40	0
5. Norris to Canyon Village	43	3	41	0
6. Canyon Village to Fishing Bridge	49	9	47	1
7. Fishing Bridge to East Entrance	43	3	41	0
8. Fishing Bridge to West Thumb	49	9	47	1
9. Madison to Old Faithful	38	6	37	0
10. Old Faithful to West Thumb	50	10	48	2
11. West Thumb to Flagg Ranch	50	10	48	2
12. Grassy Lake Road	39	0	37	0
13. Flagg Ranch to Colter Bay	41	6	40	0
14. Colter Bay to Moran Junction	43	8	41	0
15. Moran Junction to East Entrance	46	12	44	4
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	0	0	0	0
18. Moose-Wilson Road	31	0	29	0
19. Antelope Flats Snowmobile Route	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	54	7	52	0

Effects on Cultural Resources

The winter visitor use activities described in this alternative would occur on existing roads, deep snowpack over frozen ground, or frozen lake surfaces, and not affect known archeological resources. To ensure that adequate consideration and protection are accorded potential archeological resources during the construction of visitor services, such as permanent warming huts, and other day-use facilities, or of trails, archeological surveys would precede all significant ground-disturbing activities. Archeological monitoring would occur where less ground disturbance is expected. If previously undiscovered archeological resources are unearthed during construction activities, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed, if necessary. If construction impacts upon archeological sites could not be avoided the recommended mitigation strategy of site testing and data recovery would be implemented after consulting with the Wyoming State Historic Preservation Office. Consultation would ensure that the informational significance of the sites would be preserved.

If permanent warming huts or other day-use facilities are erected either in or near historic districts or potential cultural landscapes, application of several guidelines would blend facilities into both the built and natural surroundings of the parks:

1) Sensitive design and location of facilities;
2) Use of appropriate materials and colors in construction; and
3) Select plantings of native vegetation as visual buffers.

If historic structures are adaptively rehabilitated for visitor services, the integrity and character of each structure's exterior would be preserved while establishing the most efficient use of the interior's available space. All work would be performed in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1995). Materials removed during rehabilitation of historic structures would be evaluated to determine their value to the parks' museum collections or for their comparative use in future preservation work at the sites. Any corresponding visual, audible, and atmospheric intrusions associated with increases in visitation would not be significant enough to alter or diminish the integrity of historic districts or potential cultural landscapes.

Visual, audible, and atmospheric intrusions would occur in the vicinity of all construction activities. Such impacts would be temporary and minor.

Though potentially significant cultural landscapes would be protected and preserved, increased visitor use, resulting from the expansion or construction of visitor facilities and trailheads and trails, could cause overuse and degradation of contributing landscape features such as roads, trails, and structures. However, the parks' enhanced interpretive and educational programs also would increase visitor appreciation of and sensitivity to resources, as well as provide an understanding of how to experience resources without inadvertently damaging them.

The plowing of roads and highways and maintenance of groomed motorized routes throughout the winter season would have no effect upon roads or road systems that are either potentially eligible to be listed in the National Register of Historic Places or are contributing elements of potential cultural landscapes. Existing road contours would be unaltered.

There would be no adverse impacts to known ethnographic resources.

Conclusion

None of the actions described would adversely impact cultural resources.

Effects on Visitor Access and Circulation

Access

Plowing the roadway segments between West Yellowstone and Old Faithful is the principal action proposed in alternative B regarding access. West Yellowstone is the

most heavily used gateway community during the winter season and serves as a staging area for about 61,800 visitors each winter. On average, about 40% of all seasonal visitors entering through West Yellowstone visit during the month of February. Average non-holiday, daily visitation on weekends during February is about 840 without regard to mode of transportation. Snowmobile passengers, either on private sleds, rented sleds, or guided tours, account for about 90% of the visitation through this park access point. Snowcoach passengers account for the majority of the remaining visitors. Visitor surveys indicate that about 20% to 30% of visitors ski once in YNP (Littlejohn 1996; Borrie et al. 1999; Duffield et al. 2000a). Currently, these visitors park at various locations in West Yellowstone and use the oversnow vehicles to gain access to Madison, Old Faithful, and other areas of YNP.

Plowing the roadway segment between West Yellowstone and Old Faithful would close access to the park for oversnow motorized winter use recreational visitors from the West Entrance. Limited private vehicle access, including private snowmobile trailers, would be permitted within YNP. A shuttle system would provide access between West Yellowstone and Old Faithful for visitors destined for Madison or Old Faithful.

While not expressly defined in this alternative, limited access to Old Faithful would be provided for private vehicles. Under one potential scenario for private vehicle access, about 10 to 20 trailer spaces would be available at Old Faithful for snowmobile trailer parking with up to 40 spaces for passenger vehicles. These spaces would be managed through a reservation system. In addition to the private vehicle spaces, this scenario would provide up to 30 additional spaces for tour bus and shuttle vehicle staging. Visitor equivalents for private passenger vehicles and snowmobile trailers under this scenario are 116 passenger vehicle visitors (40 vehicles x 2.9 persons per vehicle) and up to 140 snowmobile passengers (20 trailer spaces x 7 (average) machines per trailer x 1 passenger per machine).

While access for oversnow motorized vehicles would be limited through this alternative, access for visitors could be increased to Madison and Old Faithful. The proposed shuttle system could potentially operate using 15-passenger vans with five-minute minimum headways (12 trips per hour). Given visitor arrival and departure rates, a shuttle system operating with 15-passenger vehicles and a peak headway of five-minutes, a maximum of 900 daily visitors can be accommodated between West Yellowstone and Old Faithful. Assuming an average of 20 buses operating daily (where there is capacity for 30 parked buses), an additional 800 visitors could be transported to Old Faithful (20 buses x 40 occupants per bus). Present access to YNP through the West Entrance is about 840 daily visitors per average February weekend. The number of winter visitors to Old Faithful that could be accommodated, including shuttle, bus, and private parking is about 1,920 through the actions of this alternative.

The current peak use is reflected by an actual count of 1,251 snowmobiles through the West Entrance (about 1,500 people). Peak use could be accommodated in this

alternative. The previous discussion involves existing capacity at Old Faithful. It is not a prediction of increased use at Old Faithful. It indicates that under this alternative the available physical parking capacity could accommodate current use levels. The existing physical capacity for snowmobiles far exceeds that for automobiles.

In GTNP and the Parkway alternative B alters the internal park circulation patterns for motorized oversnow vehicles on Teton Park Road as they currently operate. Access between Jackson Lake Junction and Jenny Lake for oversnow motorized vehicles is closed. However, other similar snowmobile opportunities are available in the park and total visitor access would not be expected to change.

The closure of YNP's West Entrance to oversnow access could enhance the importance of access for snowmobiles through GTNP and the Parkway to YNP. Winter scenery and wildlife in YNP will continue to attract potential visitors. Access for the numbers of snowmobile and snowcoach visitors currently using the West Entrance could shift to the South Entrance. The staging for oversnow opportunities from these routes could increase use at Flagg Ranch. Parking capacity would not increase at Flagg Ranch, providing an upper limit in the amount of use that may shift to this area. In addition the long travel distance from Jackson to Flagg Ranch and Flagg Ranch to destinations in YNP will remain a deterrent.

A reasonably foreseeable distribution of vehicle use as a consequence of this alternative is depicted in the following table. It shows a loss of 554 snowmobile trips from West Yellowstone to Madison and 489 from Madison to Old Faithful. Park wide snowcoach vehicle-miles would decrease by 40%. There would be a net decrease of 25% in snowmobile vehicle-miles traveled in the three park units and a net increase of 21% wheeled-vehicle-miles traveled on the same road segments.

Table 86. Alternative B motorized use.

Road Segment	*Average Daily Vehicle Use January-February*				
	Autos	**Vans**	**Snowcoaches**	**Snowmobiles**	**Buses**
Mammoth to Northeast Entrance	No change from current condition				
Mammoth to Norris	0	0	3	56	0
West Entrance to Madison	50	80	0	0	2
Madison to Norris	0	0	5	42	0
Norris to Canyon Village	0	0	4	56	0
Canyon Village to Fishing Bridge	0	0	3	242	0
Fishing Bridge to East Entrance	0	0	0	67	0
Fishing Bridge to West Thumb	0	0	3	248	0
Madison to Old Faithful	50	81	0	0	2
Old Faithful to West Thumb	0	0	4	338	0
West Thumb to Flagg Ranch	0	0	4	322	0
Grassy Lake Road	No change from current condition				
Flagg Ranch to Colter Bay	100	10	0	25	1
Colter Bay to Moran Junction	No change from current condition				
Moran Junction to East Entrance	No change from current condition				
Moran Junction to South Entrance	No change from current condition				
Teton Park Road	0	0	0	0	0
Moose-Wilson Road	5	0	0	3	0
Antelope Flats Snowmobile Route	No change from current condition				

Concession Services

Present concessions affected in this alternative would be those permitted to run oversnow guided services from West Yellowstone, into Mammoth and Gardiner into YNP, and those located at Old Faithful. This includes snowmobile and snowcoach tours. Oversnow guided tours to Old Faithful from West Yellowstone, Mammoth, and Gardiner could no longer operate in that fashion because of the change to wheeled, mass transit access (West Yellowstone to Madison, and Madison to Old Faithful). This represents the greatest adverse impact on concessions, relative to lost business and the need to completely change business focus regarding access.

Staging at Norris and Madison would be limited. The logistics of moving employees, clients, or supplies from Mammoth to Old Faithful involve travel both oversnow and via plowed road. According to the concessioner, this could make the lodging operation at Mammoth less desirable from both an operating efficiency standpoint and because it would be less enjoyable to visitors traveling between Mammoth and Old Faithful (Comment on the DEIS, YNP Lodge Co.). The result could be a less viable operation at Mammoth. Guided snowmobile and snowcoach tours from Mammoth and Gardiner

would be less attractive, because the trip to Old Faithful becomes longer, and is not as logistically feasible for day trips. This could result in lost business at Mammoth, and higher costs that would adversely affect the service provider.

From the perspective of the operation at Old Faithful, the logistics of moving people, fuel, supplies, or garbage would no longer be limited by oversnow means. Material storage in the park's interior would be less of a problem. For both Old Faithful, to a degree, and West Yellowstone, a different national park clientele could be expected. The mode of access changes between the two, but the business of moving people from one to the other remains. Therefore, opportunities would exist for new or adapting concessions/businesses based in West Yellowstone. Businesses would have two years to adapt, until road plowing would be implemented in winter 2002-2003.

Yellowstone National Park Lodge Company suggests plowing the entire north and west side of the park, thereby easing logistics and making the northern route to Old Faithful as attractive by wheeled-vehicle as the route from the west. The NPS determined that plowing the road from Mammoth to Norris and then south to Madison is not feasible for several reasons. These sections of road receive more snow and wind during the winter season than other road sections proposed for plowing. Park maintenance staff is concerned that during the deep winter, the narrow curvy road template, coupled with high crosswinds would prohibit any degree of certainty in keeping the road open. Plowing during the late winter season, as considered in alternative C, is the most feasible option for plowing these segments.

Implementing any alternative that might substantially affect a concessioner would require negotiation between the NPS and the concessioner, or be deferred until a new concessions contract is awarded.

Concessions or services operating at other locations in the parks or from other gateways would not be affected greatly. Current circumstances are attractive to snowmobilers who enter at the East and South Entrances to YNP. These circumstances would change in this alternative. Snowmobilers would no longer be able to travel from the other entrances to West Yellowstone (or the reverse) to stay overnight. Also snowmobilers would no longer be able to run the "Grand Loop." These circumstances affect a small percentage of use in the parks, most often on holiday weekends, and would have less effect on guides who facilitate this use. Most guided tour concessions engage in day use but offer some specialized Grand Loop trips with an evening stay in West Yellowstone.

Conclusion

Due to the net lack of change in access to YNP through the West Entrance, this alternative would result in negligible, short-term impacts on visitor access. In the future there could be adverse effects if the demand for available access to Old Faithful exceeds the capacity for parking at that location. Although oversnow use would be eliminated between West Yellowstone and Old Faithful, the introduction of alternative modes of

transportation would surpass the level of access currently realized through existing transportation modes. Access would not be impacted at other locations in YNP. Short-term impacts to visitor access in GTNP and the Parkway would be minor.

Effects on Visitor Experience — Yellowstone National Park

The amount and type of winter visitor opportunities offered in YNP under alternative B are provided in Table 87.

Table 87. YNP Visitor opportunities available under alternative B.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	154	-30	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Groomed motorized route, snowcoach only	0	0	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Groomed motorized trail	6	+6	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Plowed route	106	+30	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Groomed nonmotorized	47	+10	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Warming huts	9+/-	3	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Backcountry	2.2 million acres	Some restrictions in about. 700,000 acres	Contingent on snowfall in northern portion of park	None

Visitor Satisfaction and Experience

Opportunities to View Wildlife. Under alternative B visitor access from the West Entrance to Madison and south to Old Faithful is provided via a mass transit shuttle bus. Because visitors riding on the shuttle would be traveling in groups, wildlife viewing would rarely be a solitary or individualized experience. If wildlife habituates to the new travel patterns of the shuttle, wildlife viewing on this road section could be improved. Wildlife viewing opportunities on other road segments would be the same as under alternative A, no action.

Opportunities to View Scenery. Some views along the road segment from West Entrance to Old Faithful would be obstructed by snow. These types of impacts occur intermittently and generally on one side of the road for about 4 miles from the West Entrance to Madison Junction. From Madison Junction south to Old Faithful this type of terrain occurs intermittently for about 4 miles. Snow berms in this type of terrain could exceed 12 feet and would obstruct views. In areas where the terrain is open and flat, snow berms would be generally less than 6 feet (assuming snowfall accumulation of 95 inches). Snow blowing and removal could mitigate these impacts in some areas. However, visitors would experience short-term moderate adverse impacts on their

opportunities to view scenery along these road segments. These impacts would vary with the time of year, the type of vehicle used, and the amount of snowfall. Views along other park roads would not be impacted.

Because of the required use of mass transportation from West Yellowstone to Old Faithful visitors would not experience the personal freedom to stop and view scenery at will.[35]

Safety. The separation of some snowmobile and ski trails would have a minor beneficial effect on all users. An aggressive information program would provide visitors with more access to safety information as well as trail conditions and weather alerts.

Quality of the Groomed Surface. Late night closures would improve the condition of the groomed surface by allowing the groomed surface to hardened overnight. Under this alternative the poorest of the snow road sections from West Entrance to Old Faithful would be plowed. If eliminating oversnow travel displaces use to the park's eastern side, the quality of the snow surface there would decline.

The Availability of Access to Winter Activities or Experiences. This alternative eliminates snowmobile and snowcoach travel from the West Entrance to Old Faithful. In addition the road plowing option eliminates the opportunity for snowmobile and snowcoach riders to experience the entire Grand Loop oversnow. About 10% of winter day visitors indicated that they traveled the entire Grand Loop (Littlejohn 1996). For visitors wishing to visit more than Old Faithful in one day, this alternative will likely require some advance planning to access the YNP by different transportation modes. A limited number of private vehicles and buses would be allowed to access Old Faithful by reservation only. For these reasons alternative B would eliminate or detract from several critical characteristics of the desired winter experience for a large number of participants (about 48% of all winter users in 1998-99).[36]

Visitors who are unable, cannot afford, or do not wish to ride a snowmobile or snowcoach would have access via a shuttle vehicle to Old Faithful. Because the winter experience at Old Faithful has not been available to these users, alternative B would increase opportunities for this type of experience. However, the number of potential visitors who would utilize this form of access is unknown. Due to lack of public support for this alternative, the beneficial effects from this increase in opportunities are expected to be negligible.

[35] Impromptu stops by snowcoaches to view scenery and wildlife are frequent occurrences under current operations and there is no reason to assume that this situation would change.
[36] In recent surveys, plowing the road as a management option received support from only 4.2% of respondents (Duffield et al. 2000a, 2000b, 2000c). Results from the winter visitors survey indicated that under this alternative, YNP would experience an 18.4 % decrease in visitation. Similarly, of the public comments on the DEIS that voiced support for a particular management action, plowing the road received the least support (less than 1%).

This alternative would not affect oversnow access via the East, South, and North Entrances. However, the addition of another mode of transportation would add a degree of difficulty to trip planning for all winter visitors to YNP. These visitors, particularly those entering from the north, may choose to avoid the problems of transferring from oversnow travel to transit busses at Madison Junction and enter the park via the West Entrance.

The addition of groomed motorized trails would create a less maintained experience for motorized users, which has not previously been available to park visitors.

Availability of Information. Additional visitor contact stations, warming huts and an aggressive information program would enhance visitor safety and understanding of the winter environment.

Quiet and Solitude. Park visitors riding the shuttle bus on busy weekend days would find little opportunity for solitude on the road from West Yellowstone to Old Faithful. Because of the requirement for mass transit, visitors may experience more crowding at attractions such as Old Faithful, Black Sand Geyser Basin, and at the warming hut at Madison Junction. Snowmobilers that currently use the West Entrance may be displaced to other areas of the parks. This displaced use would adversely affect the ability of the snowmobile visitor to find solitude in the parks, and may increase use at attraction sites such as West Thumb and the Grand Canyon of the Yellowstone. The implementation of use limits in some areas of the park would mitigate these effects.

Because use in important or sensitive resource areas is restricted to designated trails, backcountry skiers may find reduced opportunities for solitude under alternative B.

Under this alternative, all oversnow vehicles would be required to meet strict sound standards. These standards would be implemented at various levels over the next 10 years. While the short-term changes in the soundscape would be minor, the long-term goal of reducing snowmobile sound emissions would greatly enhance the ability to experience quiet in YNP. The use of mass transit shuttle buses would also increase opportunities to experience quiet, particularly near the West Entrance to Old Faithful travel corridor.

Clean Air. Under alternative B, all oversnow vehicles would be required to meet strict emissions standards. These standards would be implemented at various levels over the next 10 years. While the short-term (less than 5 years) changes in visitor experience would be minor, the long-term goal of reducing snowmobile emissions and the use of mass transit shuttle buses would greatly enhance the ability to experience clean air in YNP. These effects would be particularly beneficial at the West Entrance and Old Faithful.

Conclusion

Alternative B would eliminate or detract from several critical characteristics of the desired winter experience. These adverse impacts would affect winter visitors that access YNP via the West Entrance on snowmobiles and in snowcoaches (about 48% of all winter visitors). This action would result in major to moderate adverse impacts to the desired winter experience of these visitors.

Plowing the road from the West Entrance to Old Faithful would create berms of snow that would limit opportunities to view scenery in some areas. Logistically, travel in YNP would become more complex, particularly for travelers entering the park from the north. This action would have a direct minor to moderate adverse impact on the desired winter experiences of visitors traveling these corridors.

The winter experience at Old Faithful has not been available to park visitors who do not wish or who cannot afford to ride a snowmobile or snowcoach. Because alternative B would provide a previously unavailable winter experience, it would have benefits for park visitors in this group. However the magnitude of effect of this action is expected to be negligible.

The reduction of snowmobile emissions and sound levels would, over time, provide increased opportunities for clean air, and natural quiet. The result of these actions would result in moderate to major beneficial improvements to the desired visitor experience.

Under specific circumstances, the adaptive management provisions of this alternative may result in area closures. If monitoring or scientific studies regarding winter visitor use, natural resources, and other park values indicate that sections of the park must be closed or certain uses restricted to protect park values (for example, snowmobiling or backcountry skiing), some or all visitor experiences in the closure area would be eliminated (see Chapter II, *Adaptive Management*). These areas of closure would result in direct localized adverse impacts on the desired winter visitor experience. However, the long-term protection of these resources would provide major benefits to the desired visitor experiences park-wide.

Effects on Visitor Experience — Grand Teton National Park and the Parkway

The amount and type of winter visitor opportunities offered in GTNP under alternative B are provided in Table 88.

Table 88. GTNP Visitor opportunities available under alternative B.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	2.1	0	December to April†	Late night closure
Groomed motorized route, snowcoach	2.1	0	December to April†	Late night closure
Groomed motorized trail	34.0	0	December to April†	Late night closure
Plowed road	100.0	0	December to April†	Late night closure
Ungroomed motorized trail or area	11.3	-24.3	December to April†	Late night closure
Groomed nonmotorized	0	0	December to April†	Late night closure
Ungroomed nonmotorized trail or area	32.9	6.5	December to April†	Late night closure
Warming huts/Interpretive centers	6.0	4.0	December to April†	Late night closure

† Variable, dependent on snow conditions

Visitor Satisfaction and Experience

Opportunities to view wildlife and scenery. Visitors on plowed roads, the CDST, and Jackson Lake would continue to enjoy wildlife and scenery viewing. Fewer viewing opportunities would be available for snowmachine users along the Teton Park Road and on Jackson Lake. Viewing opportunities for nonmotorized users in these areas would be similar to the no action alternative.

Safety (the safe behavior of others). Eliminating oversnow vehicles from the Teton Park Road would result in greater separation of motorized and nonmotorized users compared to alternative A. Separation of the CDST from the highway on a newly constructed, year-round pathway would enhance safety.

Quality of the groomed surface. There would be no fewer groomed surfaces in this alternative than in alternative A. Grooming more frequently would enhance the surface of the Grassy Lake Trail. Relocating the CDST to a separate path from Colter Bay to Flagg Ranch would improve the snow quality of the groomed surface while separating auto traffic from snowmachines.

The availability of access to winter activities or experiences. The forms of access would remain the same as in alternative A, but fewer miles of ungroomed motorized trails would be available. Ice fishing opportunities via snowmobile would be lost on Jackson Lake over time. Currently this represents a quarter of the angling that occurs year-round. Because snowmobiles would no longer be permitted on Jackson Lake, some backcountry skiers would find travel more difficult, particularly to Webb Canyon.

Availability of information. Increased and enhanced visitor programs, facilities, and interpretive opportunities would better meet the expectation and need for information.

Quiet and solitude. Reducing motorized sound levels over time and separating uses on the Teton Park Road would enhance quiet use opportunities, particularly for nonmotorized visitors. Opportunities for solitude would be greatly increased for nonmotorized uses. The sound of snowplanes would continue to impact backcountry users in GTNP in some areas west of Jackson Lake.

Areas of the park that have previously not experienced high levels of snowmobile use may experience an increase. Snowmobile users that currently enter the parks from the West Entrance of YNP may be displaced to other areas of the parks if mitigating interim use limits are not implemented. This displaced use would adversely affect the ability of the snowmobile visitor to find solitude and quiet in the parks, and could increase levels of use particularly from the South Entrance.

Clean air. Over time reduction of allowable emission levels, combined with separation of uses on the Teton Park Road would help meet expectations for clean air, particularly for nonmotorized users.

Conclusion

Changes in opportunities for visitor experience relating to wildlife and scenery viewing would be negligible. Separating user groups within the park and improving groomed surfaces would result in moderate benefits to safety. Access to winter activities would decrease moderately due to the net loss of areas available for snowmobile use. There would be a major beneficial improvement to visitor experience due to greatly increased availability of information, interpretation, and winter programs. Generally, there would be a moderate beneficial impact to opportunities for quiet and solitude. Opportunities to appreciate clean air would be moderately to greatly improved, particularly in the Flagg Ranch area.

IMPACTS OF IMPLEMENTING ALTERNATIVE C

Effects on the Socioeconomic Environment

Alternative C contains several provisions for relatively minor changes in trails management and grooming within YNP and GTNP. Most of these changes would not substantially affect visitor decisions on whether to visit the parks for recreation. Like alternative B, the proposal to plow the road from West Yellowstone to Madison Junction to Old Faithful has the potential to significantly impact GYA visitation levels and, therefore, visitor expenditures and the overall level of economic activity within the GYA.

Regional Economy. The impacts of alternative C with regard to plowing the West Yellowstone to Old Faithful road are the same as for alternative B. The effects of alternative C on visitation and visitor expenditures in GTNP and the Parkway are expected to be the same as alternative B.

In addition to the plowing of the West Yellowstone to Old Faithful road segment, alternative C proposes plowing the road from mid-February to mid-March from Mammoth to Norris to Madison for auto and bus use. Alternative C proposes to allow only snowcoach, ski, and snowshoe travel in the eastern portion of the park (Norris to Canyon to Fishing Bridge roads) from mid-February to mid-March. It is unknown if the combination of decreased snowmobiling opportunities and increased auto and ski opportunities would effect overall winter visitor numbers.

Three-State Regional Economy. The impacts of alternative C on the three-state regional economy with regard to plowing the West Yellowstone to Old Faithful road are the same as for alternative B.

Minority and Low-Income Populations. It is anticipated that the impacts on minority and low-income populations from the proposed alternative C actions would be the same as those found under alternative B.

Social Values. It is anticipated that the impacts on social values from the proposed alternative C actions would be the same as those found under alternative B.

Nonmarket Values. It is anticipated that the impacts on nonmarket values from the proposed alternative C actions would be similar to those found under alternative B. The exception is that under alternative C, there would be no benefits to snowmobile users from a requirement to use clean and quiet technology in the future.

Conclusion

Like alternative B, alternative C road plowing actions would have a negligible to minor impact on the five-county and three-state economies through reduced visitation and nonresident visitor expenditures. These expenditure reductions may be a moderate negative impact on small communities adjacent to YNP, primarily West Yellowstone. The alternative C road plowing actions would also have a moderate negative impact on total current trip nonmarket visitor benefits (through reduced visitation) and a minor positive impact on nonmarket benefits through improved winter access to Old Faithful. Low-income visitors could realize a minor to moderate benefit from the alternative C actions, which would make access to the YNP more affordable.

Effects on Air Quality and Public Health

Like Alternative B, under Alternative C snowmobiles would no longer enter YNP at the West Entrance and travel to Old Faithful. These snowmobiles and snowcoaches would be displaced by wheeled-vehicles that would operate on a plowed road from the West Entrance to Old Faithful. Alternative C would have fewer mass transit vans operating to Old Faithful from the West Entrance than alternative B, and only bio-based lubricants and 10% ethanol fuel blends would be sold in the park for all vehicles. Table 89, Table 90, and Table 91 summarize the results of CO modeling for six locations in the three parks for alternative C. Table 89 and Table 90 show the predicted maximum 1-hour

average CO concentrations and the calculated maximum 8-hour average CO concentrations, respectively. Table 91 also provides the percent contribution of each vehicle type, including snowplows, to the maximum CO concentrations for the six locations. Table 92 and Table 93 provide corresponding model results for PM_{10} for the same locations and conditions as those for CO.

Visibility

The visibility assessment indicates that under this alternative, vehicular emissions would not cause any perceptible visibility impairment near the West Entrance or along the roadways. Perceptible visibility degradation could occur near Old Faithful and Flagg Ranch when vehicles idle for extended periods.

Conclusion

As noted in Table 89, Table 92, and Table 93, the model predicts major beneficial impacts relative to alternative A at the West Entrance and along the West Entrance to Madison roadway. Like alternative B, both CO and PM_{10} concentrations would be reduced by more than 85%. Moderate CO reductions are predicted for alternative C at the Old Faithful staging area, and a minor beneficial impact on CO concentrations is predicted at the Flagg Ranch staging area and along the Flagg Ranch to Colter Bay roadway. For PM_{10} a major beneficial impact would be realized at the Old Faithful and Flagg Ranch staging areas, and a moderate beneficial impact is predicted along the Flagg Ranch to Colter Bay roadway.

Table 89. Maximum 1-hour average CO concentrations for alternative C.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/Background) (ppm)	Change Relative to alternative A (w/o Background) (%)
West Yellowstone Entrance	0.60	3.60	97.9
West Entrance to Madison Roadway	0.30	3.30	97.5
Old Faithful Staging Area	0.99	3.99	22.8
Flagg Ranch Staging Area	1.39	4.39	19.0
Flagg Ranch to Colter Bay Roadway	1.00	4.00	9.1
Mammoth to NE Entrance Roadway	0.30	3.30	0

Table 90. Maximum 8-hour average CO concentrations for alternative C.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/Background) (ppm)	Change Relative to alternative A (w/o Background) (%)
West Yellowstone Entrance	0.28†	1.69†	97.9
West Entrance to Madison Roadway	0.14†	1.55†	97.5
Old Faithful Staging Area	0.17	1.57	22.8
Flagg Ranch Staging Area	0.23	1.64	19.0
Flagg Ranch to Colter Bay Roadway	0.47†	1.88†	9.1
Mammoth to NE Entrance Roadway	0.14†	1.55†	0

†Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 91. Vehicle contribution to CO concentrations for alternative C.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	0	0	27.5	54.0	2.3	1.5	14.7
West Entrance to Madison Roadway	0	0	23.1	58.4	1.6	1.0	15.9
Old Faithful Staging Area	77.9	0.9	6.0	12.0	0.1	0.1	3.0
Flagg Ranch Staging Area	78.9	0.8	6.1	12.0	0.1	0	2.0
Flagg Ranch to Colter Bay Roadway	49.8	0	13.3	31.1	0.3	0.2	5.3
Mammoth to NE Entrance Roadway	0	0	26.5	66.8	0.6	0	6.1

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Table 92. Maximum 24-hour average PM_{10} concentrations for alternative C.

Location	24-hr Maximum Concentration (w/o background) ($\mu g/m^3$)	24-hr Maximum Concentration (w/background) ($\mu g/m^3$)	Change Relative to alternative A (w/o background) (%)
West Yellowstone Entrance	0.32†	23.32	99.3
West Entrance to Madison Roadway	0.32†	23.32	97.1
Old Faithful Staging Area	0.18	5.18	71.5
Flagg Ranch Staging Area	0.26	5.26	59.5
Flagg Ranch to Colter Bay Roadway	0.63†	5.63	33.3
Mammoth to NE Entrance Roadway	0.32†	5.32	0

†Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 93. Vehicle contribution to PM_{10} concentrations for alternative C.

Location	Contribution (%)

	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	0	0	4.5	9.2	51.9	31.8	2.5
West Entrance to Madison Roadway	0	0	8.9	18.7	43.2	24.1	5.1
Old Faithful Staging Area	98.0	0	0	0	1.0	1.0	0
Flagg Ranch Staging Area	98.8	0	0	0	0.7	0.4	0
Flagg Ranch to Colter Bay Roadway	39.8	0	9.9	19.4	19.6	7.9	3.3
Mammoth to NE Entrance Roadway	0	0	20.3	42.8	33.0	0	3.9

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Effects on Public Safety

The safety-related effects of plowing the road from West Yellowstone to Old Faithful would be similar to those of alternative B. However, potential for visitor conflicts on this road would increase due to the absence of shuttle buses and reservation limitations on private wheeled-vehicles. Unregulated private wheeled-vehicle access to both road segments would have moderate adverse impacts on the safety of park visitors. Some visitors entering the YNP in private vehicles would be ill-prepared for the harsh environment and dangerous winter road conditions. This would result in increased motor vehicle accidents, vehicle-wildlife collisions, and risk of injury due to exposure to extreme winter conditions. The late season plowing of the roadway segments from Madison to Mammoth would have the same effects as plowing the road from West Yellowstone to Old Faithful. Restricting use on the road from Norris to Canyon to snowcoaches only would reduce the potential for visitor conflicts during one month of the season.

In GTNP this alternative would slightly decrease the potential for inter-modal conflict by widening the highway shoulder between Moran and Flagg Ranch. It would increase the potential for user conflict by developing or maintaining ungroomed trails for use by both motorized and nonmotorized uses in close proximity along the Teton Park Road and Signal Mountain Road.

Conclusion

Implementing this alternative would result in moderate adverse impacts to public safety in YNP. This is primarily due to the potential for increasing visitor conflicts and vehicle-animal collisions that would result from plowing several road segments (in the absence of offsetting beneficial effects or mitigation). The safety effects of a greater separation of uses would be negligible. Impacts to public safety are expected to be minor and adverse due to the introduction of potential user conflicts.

In GTNP the widened highway shoulder for the CDST would only negligibly improve safety, because it would not extensively alter the actions currently in place to separate snowmobile and wheeled-vehicle use along the trail.

Effects on Geothermal Features

Under alternative C the park roads would be groomed near the geothermal features described in alternative B. The impacts on those features described in alternative B would be similar under this alternative.

Plowing the road from West Yellowstone to Madison and Madison to Old Faithful would have similar impacts on geothermal features as those described in alternative B. There could be increased adverse impacts on geothermal features given no fall closure along the plowed road, and visitors would be able to access the features along the road throughout the fall and early winter.

Access to Old Faithful by both snowmobiles and wheeled-vehicles would have similar impacts on Old Faithful features as described under alternative B.

The number of nonmotorized groomed trails in geothermal areas would increase. The geothermal areas included in this activity are Mammoth Terraces, Lone Star Geyser Basin, Norris Geyser Basin, the lower geyser basin, and Fountain Flats. New groomed trails would increase access and in turn increase potential adverse impacts on geothermal areas. Overall, the proposed new groomed nonmotorized trails would result in a minor increase in impacts on geothermal basins.

The construction of a Norris warming hut would have the same impacts on geothermal features as those described under alternative A. Winter campsites would be provided at Old Faithful, which could increase the amount of visitor use overnight and of the geothermal basin. More visitors in the area would cause minor increases in adverse impacts on the geothermal features. Unregulated backcountry use would have the same impacts on geothermal features as described under the no action alternative. Increased interpretation opportunities would have the same beneficial impacts on geothermal features as described under alternative B.

Conclusion

Actions in alternative C could result in an overall increase in human access to geothermal areas at Old Faithful, Norris, West Thumb, and in areas located along the roads from Madison to Old Faithful. These actions include plowed roads, longer fall and spring seasons, warming huts, winter camping, spring plowing, groomed motorized and nonmotorized trails, and nonrestricted backcountry use. As a result there would be minor incremental long-term degradations to thermal features, and in some cases permanent loss of certain features. By increasing interpretative opportunities, some of the effects of increased use could be mitigated.

Water and Aquatic Resources

Potential pollution sources are the same as described in alternative A. The potential impacts on water quality would be the same as described in alternative B with the following exceptions.

There would be no change in risk along the Teton Park Road ("low" risk) segment from that described in alternative A. There would be no change in the input of pollutants on the surface of Jackson Lake, hence no reduction in the risk of degradation in that water body.

The risk of water quality pollution would be decreased along the "low" risk Moose-Wilson Road segment with the prohibition of snowmobiles. The risk of water quality pollution would be increased along the "low" risk Antelope Flats Snowmobile Route with the increase of snowmobiles on that segment.

Table 94.[37] Snowmachines and associated risk levels for alternative C.

Road Segment	Risk Rating†	Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. A*		Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. C*	
		SM	SC	SM	SC
Mammoth to Norris	Medium	641	69	1176	63
West Entrance to Madison	Medium	7759	127	0	0
Madison to Norris	High	3458	73	588	56
Norris to Canyon Village	Low	2214	47	672	48
Canyon Village to Fishing Bridge	High	2370	50	3872	48
Fishing Bridge to East Entrance	Medium	983	0	1809	0
Fishing Bridge to West Thumb	Medium	2627	55	5208	63
Madison to Old Faithful	High	7818	165	0	0
Old Faithful to West Thumb	Medium	3560	73	5746	68
West Thumb to Flagg Ranch	Medium	4219	103	7728	96
Grassy Lake Road	High	184	0	400	0
Flagg Ranch to Colter Bay	Low	379	0	800	0
Colter Bay to Moran Junction	High	248	0	250	0
Moran Junction to East Entrance	Medium	49	0	50	0
Teton Park Road	Low	156	0	0	0
Moose-Wilson Road	Low	6	0	6	0
Antelope Flats Snowmobile Route	Low	0	0	0	0

Conclusion

Deposition into snowpack would continue to occur from 2-stroke engine emissions along groomed park roads in YNP and GTNP. The effect of this deposition on water quality is undetermined, but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. It is possible that accumulations of pollutants in aquatic systems may have adverse impacts on wetlands and aquatic resources downstream from

[37] SM = Snowmobile, SC = Snowcoach; the source of pollutants is emissions from snowmobiles, which produce (conservatively) ten times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce fewer emissions then single snowmobiles.
†High = within 100 meters of aquatic system on 76% to 100% of the road segment; Medium = within 100 meters on 51% to 75% of the road segment; Low within 100 meters of rivers less than 50%.

high risk road segments. Oversnow vehicle use in this alternative involves localized high risk to surface water quality, but reduces oversnow vehicle-miles traveled along high risk road segments in the three park units by about 62%. Snowmobile and snowplane use on Jackson Lake would continue the risk of moderate to major adverse impacts on water quality in that water body. Minor to moderate long-term adverse impacts on water resources throughout GTNP and the Parkway could occur because of the increased number of winter use opportunities. Minor short-term water quality and wetland impacts could occur in streams along the eastern side of US 89/287 as a result of CDST construction.

Mitigation

The portions of the CDST that would deviate from the road shoulder would be designed and sited to minimize impacts on all park resources including wildlife, vegetation, and wetlands. Focused water monitoring programs should be designed and implemented to determine whether there are specific aquatic resource effects from winter recreational use. The use of bio-based fuels by NPS and the availability of fuels in gateway communities may result in a minor decrease in pollutant deposition into snow. Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation. The release of snowpack contaminants into surface water could be mitigated by disconnecting snowmelt drainages from motorized trails. Any new or reconstructed winter use sanitary facilities would be constructed in locations and use advanced technologies that would protect water resources. A focused program of monitoring would reduce the uncertainty of impacts from oversnow vehicles, and if necessary, indicate best management practices that might be implemented.

Effects on Wildlife

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative C GTNP and the Parkway would groom about 66 miles for motorized use, an increase of about 30 miles over current management, and 4 miles for nonmotorized use. The new groomed motorized route will begin near the south boundary, follow the Gros Ventre River, and then parallel the eastern boundary up to Moran. YNP would groom 164 miles for motorized use, a decrease of 20 miles, and 47 miles for nonmotorized use. This represents an increase of 10 miles over current management.

In GTNP effects related to packed trails would be greater than those under alternative A. The elimination of a packed road surface from West Entrance to Old Faithful would decrease impacts associated with groomed roads relative to alternative A.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause injury and death to wildlife, especially in poor lighting conditions and during snowfall, and can cause displacement from preferred habitats.

The addition of 30 miles of oversnow motorized trail in GTNP could result in moderate to major impacts on wildlife. The new trail along the Gros Ventre River would displace ungulates, primarily moose and elk, from the river corridor and inhibit movements within and among winter ranges in the southern part of the park. The periodic departure of the CDST from the highway shoulder to scenic diversions could also impact ungulates, especially moose on the segment from Moran to Jackson Lake. In YNP the associated effects of oversnow motorized vehicles would be reduced due to the plowing of the route from West Yellowstone to Old Faithful.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, also may provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative C the effects described above are associated with about 106 miles of road in YNP, an increase of 30 miles over existing management to accommodate private wheeled-vehicles from West Entrance to Old Faithful. The miles of plowed roads in GTNP and the Parkway would increase marginally from about 100 miles to 104 miles to allow for wheeled-vehicle access on the Moose-Wilson Road.

In YNP the plowed road from West Entrance to Old Faithful would result in more snow berms, thus potentially increasing fragmentation along this segment. An increase in ungulate use of the plowed road as compared to the currently groomed road is not expected because plowed roads do not offer additional energy savings over groomed roads. The effects of plowed roads in GTNP would be essentially the same as those described in alternative A.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

The use of plowed roads by wheeled-vehicles may increase wildlife-vehicle collisions and displacement over current rates along the road segment from West Yellowstone to Old Faithful. These effects would be increased relative to alternative B because alternative C does not call for mass transit, nor does it prohibit late night travel. In addition plowing the Moose-Wilson Road would potentially impact moose that winter along this corridor.

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative C, YNP increases nonmotorized opportunities by grooming an additional 10 miles (from 37 miles to 47 miles) and adds 8 more miles after motorized use ceases late in the winter season. Ungroomed trails in GTNP and the Parkway increase from 26 miles to 28 miles, and groomed trail increase 4 miles.

Overall, the potential for an increase in adverse effects is low because trails would not be located in areas of high importance to wintering ungulates. Exceptions include trails located near thermal areas (e.g., Mammoth Hot Springs or Old Faithful), or in other areas of ungulate use in the winter (e.g., moose near the Gros Ventre campground trail). Similar to alternative B, these trails could have minor effects on ungulates.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Impacts under this alternative generally would be the same as in alternative A. In GTNP moderate to major adverse impacts on bighorn sheep would continue, as well as potential impacts to moose, elk, and bison on Blacktail Butte and Wolff Ridge.

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Alternative C proposes an increase in the number and size of warming huts and other day-use facilities. In addition this alternative proposes the establishment of winter campsites in the Old Faithful area. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate (e.g., Tower, Norris, and Canyon). Warming huts near ungulate winter range important to elk, deer, and bison would potentially increase human use and consequently reduce habitat effectiveness. However, over time the predictable nature of the recreation expected to occur in the area may allow species to habituate to increased human activity. The effects of these huts on ungulates would be the same for all alternatives.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative C, GTNP and the Parkway would groom about 66 miles, an increase of about 30 miles over current management and 4 miles for nonmotorized

use. The new groomed motorized route would begin near the south boundary, follow the Gros Ventre River, and then parallel the eastern boundary up to Moran. GTNP would also groom new nonmotorized trails in the Gros Ventre River Campground and at Two Ocean Lake. YNP would groom 164 miles, a decrease of 20 miles, and 47 miles for nonmotorized use, an increase of 10 miles over current management.

Overall effects related to packed trails would increase as compared to alternative A, especially in GTNP. Because the area of the new groomed snowmobile route in the southern part of the park is not lynx habitat, impacts on lynx would only be expected to increase in the Two Ocean Lake area.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. To date oversnow motorized vehicles have not killed any federally listed species.

In GTNP the proposed snowmobile trail from Jackson along the east boundary of the park to Moran could result in a significant increase in snowmobiling activity along the Gros Ventre River, up to the Triangle Ranch along the eastern park boundary, and along US 89 to Moran Junction. This trail would introduce snowmobiling use adjacent to areas such as Elk Ranch, Uhl Hill, and Wolff Ridge, which are important winter range for ungulates, and subsequently, wolves. Snowmobiling near these areas could result in human-wolf interactions, displacement of prey (primarily elk), and consequently displacement of wolves. The periodic departure of the CDST from the highway shoulder to scenic diversions could also displace lynx and snowshoe hares. Effects to other species are similar to those in alternative A.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). In addition similar to groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow. Under alternative C the effects described above are associated with about 106 miles of road in YNP, an increase of 30 miles over existing management to accommodate private wheeled-vehicles from West Entrance to Old Faithful. The miles of plowed roads in GTNP and the Parkway would increase marginally from about 100 miles to 104 miles to allow for wheeled-vehicle access on the Moose-Wilson Road.

Impacts of plowed roads on federally protected species would be the same as alternative A.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those of traffic on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

The road from West Yellowstone to Old Faithful would be plowed and open to public access two weeks earlier under this alternative, potentially leading to an increase in human-bear interactions during the pre-denning period. However, none of the radio-collared bears in YNP have denned along this road segment, and only about 10% of bears are still active at this time (Haroldson et al. in prep.). This alternative also calls for extending the length of the winter use season from the South Entrance to West Thumb by two weeks from mid-March to the beginning of April. This period of time overlaps with den emergence for bears (about 65% of bears are out of their dens by April (Haroldson et al. in prep.). Consequently, this alternative feature may have minor to moderate adverse effects on bears, including displacement and habituation of bears to human foods and garbage associated with human developments. This may lead to more bear-human confrontations and management actions. Effects related to plowed roads in GTNP would remain the same as under current management.

Other impacts related to displacement would be the same as those under alternative A. Collision impacts may be greater than those under alternative A because the roads are open for a longer period.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative C, YNP increases nonmotorized opportunities by grooming an additional 10 miles (from 37 miles to 47 miles) and adds 8 more miles after motorized use ceases late in the winter season. Ungroomed trails in GTNP and the Parkway increase from 26 miles to 28 miles and groomed trails increase by 4 miles.

Overall, the potential for an increase in adverse effects to wolves is low because trails would not be located in areas of high importance to wintering ungulates and consequently, wolves. Exceptions include trails located near thermal areas (e.g., Mammoth Hot Springs or Old Faithful), or in other areas of ungulate use in the winter (e.g., the Gros Ventre campground trail). Lynx could be impacted by trails at Two Ocean Lake. Furthermore, when warranted the parks may close any area where federally protected species are observed. Other effects are the same as those under alternative A.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and federally protected wildlife species may only occur sporadically, they may cause displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction.

Impacts under this alternative generally would be the same as in alternative A.

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species by the presence of human food and garbage, and lead to human-wildlife conflicts. In addition increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Alternative C proposes an increase in the number and size of warming huts and other day use facilities. In addition this alternative proposes the establishment of winter campsites in the Old Faithful area. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate or nonexistent (e.g., Tower, Norris, and Canyon). Warming huts near ungulate winter range important to elk, deer, and bison would potentially increase human use and consequently reduce habitat effectiveness. Displacement of ungulates could lead to displacement of wolves. However, over time the predictable nature of the recreation expected to occur in the area may allow ungulates to habituate to the increase in human activity. Additional developments in or near lynx habitat could potentially displace lynx.

The construction of new campsites at Old Faithful, new and enlarged warming huts at Norris and Tower, and additional support facilities at GTNP (e.g., at Two Ocean Lake) may increase human use in those areas and may lead to minor negative effects on late winter and spring food availability for emerging bears in an area of currently low human use. Garbage and human foods improperly stored at park winter use destination areas can lead to adverse impacts on bears before and after the winter use season.

To date YNP does not have adequate winter garbage storage facilities, but will rectify this issue by constructing a winter garbage storage facility that is wildlife-proof in the Old Faithful, Grant, Lake, and Canyon areas (a feature of all alternatives). Similar to alternative B, the availability of plowed roads into the park's interior would allow for garbage removal, thus decreasing problems associated with habituation.

Compared to current management, impacts related to displacement would be greater due to the increase in number of facilities. Specifically, huts located in thermally influenced ungulate winter range could displace ungulates, and thus affect bison and elk carcass availability, important spring foods for grizzly bears. Because ungulates have been known to habituate to predictable human activities, any displacement would most likely be short term. The extension of the winter use season combined with increased human activity near new support areas may lead to more bear-human conflicts.

Species of Special Concern

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by:

- Facilitating travel into areas that would normally be inaccessible due to deep snow
- Inhibiting foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey
- Reducing subnivian prey availability by increasing mortality of these small mammals.

Under alternative C, GTNP and the Parkway would groom about 66 miles, an increase of about 30 miles over current management, and 4 miles for nonmotorized use. The new groomed motorized route will begin near the south boundary, follow the Gros Ventre River, and then parallel the eastern boundary up to Moran. GTNP would also groom new nonmotorized trails in the Gros Ventre River Campground and at Two Ocean Lake. YNP would groom 164 miles for motorized use, a decrease of 20 miles, and 47 miles for nonmotorized use, an increase of 10 miles over current management.

Impacts discussed under alternative A would potentially increase, especially in GTNP. Additional miles of groomed trail in GTNP could increase impacts on martens and fishers. New groomed trails are not in swan habitat.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts to park species of special concern are displacement from preferred habitats, and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare. In 10 years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998).

Impacts would increase relative to alternative A. The separation of the CDST from the plowed roadway would cumulatively increase displacement impacts associated with the use of both oversnow and wheeled-vehicles.

See *Water and Aquatic Resources*, Chapter IV for an assessment of the impacts of exhaust on the aquatic environment in the parks.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative C the effects described above are associated with about 106 miles of road in YNP, an increase of 30 miles over existing management to accommodate private wheeled-vehicles from West Entrance to Old Faithful. The miles of plowed roads in GTNP and the Parkway would increase marginally from about 100 miles to 104 miles to allow for wheeled-vehicle access on the Moose-Wilson Road.

Impacts related to plowed roads would increase slightly in YNP compared to alternative A. Effects related to plowed roads in GTNP would remain the same as under current management.

Effects of motorized use of plowed roads. The most likely impact to park species of special concern is displacement from preferred habitats and mortality caused by collisions.

Under alternative C impacts related to plowed roads would slightly increase in YNP as compared to alternative A. In particular swans that winter in open water habitats along

the plowed road from West Yellowstone to Old Faithful may be disturbed by the increase in wheeled-vehicle traffic along this route. If vehicles stop for people to get out to view swans, swans could be adversely impacted by displacement.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative C YNP increases nonmotorized opportunities by grooming an additional 10 miles (from 37 miles to 47 miles) and adds 8 more miles after motorized use ceases late in the winter season. GTNP and the Parkway increase ungroomed trails from 26 miles to 28 miles and add 4 miles of groomed trail.

Although the above effects may be increased due to the addition of nonmotorized routes, they are expected to be relatively minor because most routes would not be located in areas critical to species of special concern (e.g., adjacent to open water habitats and ungulate winter ranges).

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent than nonmotorized use on designated routes. Consequently, although encounters between backcountry users and species of special concern may occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction.

Impacts are generally as stated in alternative A — negligible to minor. If activity by species of concern is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on species of special concern in the park are associated with increases in human activity and the subsequent disturbance and displacement of species or their prey. Alternative C proposes an increase in the number and size of warming huts and other day-use facilities. In addition this alternative proposes the establishment of winter campsites in the Old Faithful area. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate (e.g., Tower, Norris, and Canyon).

Compared to current management, impacts related to displacement would be greater due to the increase in facilities. Specifically, huts located in thermally influenced ungulate winter range could displace ungulates, and thus affect bison and elk carcass availability for wolverines, fishers, and marten. Because ungulates have been known to habituate to predictable human activities, any displacement would most likely be short term. Impacts on other species of special concern would be the same as those under alternative A.

Conclusion

This alternative maximizes winter visitor opportunities for a range of experiences, while emphasizing motorized recreation. Consequently, effects on wildlife associated with oversnow and wheeled-vehicles increase. Plowing the road from Yellowstone to Old Faithful to accommodate private vehicles may lead to more collisions than under alternative B because there are no provisions for mass transit or restrictions on late night travel. Effects related to groomed trails and snowmobiles increase substantially in GTNP. The establishment of a groomed snowmobile trail from GTNP's south boundary to Moran along the eastern park boundary may negatively impact wildlife, including ungulates, wolves, and lynx. Periodic diversions of the CDST to points of interest may affect moose and lynx in the northern part of the park. In YNP the extension of the winter use season from mid-March to the beginning of April from the South Entrance to West Thumb combined with an increase in winter support facilities may result in an increase in grizzly bear–human conflicts. Effects may be mitigated to a degree by an increased emphasis on visitor education and interpretive opportunities, as well as increased administrative capability.

Although impacts on populations resulting from winter recreation are neither long term nor significant, impacts on individual members of the population can be important, leading to death either directly from collisions or continued harassment, or indirectly through management actions taken as a response to habituation to human presence and food. Although concerned about impacts on individuals, the NPS primarily provides for the protection of native animals populations from management actions (with the exception of federally protected species). For example, see Chapter II in NPS 77, Natural Resources Management.

Ungulates

- Effects of groomed roads and trails on animal movements – unknown if and to what extent beneficial effects outweigh negative effects. Effects would increase in GTNP and decrease in YNP relative to alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: 1) mortality caused by collisions – adverse, negligible, and short term, and 2) displacement from preferred habitats – adverse, moderate to major, and short term. In GTNP effects would increase relative to alternative A. In YNP effects would decrease [relative to alternative A].
- Effects of plowed roads on: 1) habitat fragmentation – effects in YNP would increase over alternative A — adverse, minor, and short term; in GTNP effects would remain the same; and 2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects; any effects would remain essentially the same as those associated with groomed roads in alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, minor, and short term; and 2) displacement from preferred habitats – adverse, moderate, and long term. Effects would increase relative to alternatives A and B in YNP and remain the same in GTNP.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, minor, and short term. Generally the same as alternative A, but may increase slightly.

- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, moderate, and short term. Impacts to bighorn sheep in GTNP would be moderate to major and long term if no mitigation is applied. Same as alternative A.
- Effects of the presence and use of winter support facilities on displacement – adverse, minor, and short term. May increase slightly relative to alternative A because more huts are proposed.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: 1) bald eagles, grizzly bears, and wolves – no effect; and 2) lynx – adverse, negligible to major, and short term, depending upon lynx distribution and abundance in the parks. Increased groomed trails in GTNP would increase effects to lynx relative to alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – adverse, minor, and short term (wolves and lynx), adverse, negligible, and short term (bald eagles), and no effect (grizzly bear). Effects may increase for wolves relative to alternative A.
- Effects of plowed roads on: 1) habitat fragmentation – no effect on any of the listed species; and 2) animal movements – no known effect on any of the listed species. Same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – effects may increase over alternative A – adverse, negligible, and short term on bald eagles; adverse, minor, and short term on wolves, grizzlies; no known effect to date on lynx; and 2) displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no known effect to date on wolves and lynx; adverse and minor to moderate for grizzly bears because of the longer winter use season.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no effect on grizzly bears; no known effect to date on wolves; minor adverse effect on lynx. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, minor, and short term on bald eagles; adverse, negligible, and short term on grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx. Same as alternative A.
- Effects of the presence and use of winter support facilities on displacement – no affect on bald eagles; adverse, minor, and short term on grizzly bears (with mitigation) and wolves; unknown effect on lynx. May slightly increase relative to alternative A because more huts are proposed.

Species of Special Concern

- Effects of groomed roads and trails on 1) animal movements – no known effect on wolverines; adverse, negligible, and short term on fishers and martens; no effect on otters, swans, reptiles, amphibians, and fish; 2) foraging activities – adverse, negligible, and short term on marten; no effect on the other species; and 3) subnivian prey availability — adverse, negligible, and short term on marten; no effect on the other species. Impacts would generally increase relative to alternative A, especially in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect on wolverine; adverse, negligible, short term on fishers, marten; no effect on otters, reptiles, amphibians, fish; adverse, minor, short term on swans. Impacts would increase relative to alternative A, especially in GTNP.
- Effects of plowed roads on animal movements – no known effect on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish. Slight increase in effects in YNP relative to alternative A, no change in GTNP relative to alternative A.
- Effects of motorized use of plowed roads on 1) displacement from preferred habitats – adverse, negligible, and short term on wolverines, fishers, and martens; no effect on otters, reptiles, amphibians, and fish; adverse, negligible, and short term on swans; and 2)

mortality from collisions — adverse, negligible, and short term on otters and martens; no effect to date on other species. Effects may increase slightly relative to alternative A in YNP.

- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect on wolverines; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; adverse, negligible, and short term on sagebrush lizard; no effect on rubber boa, amphibians, and fish. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible, and short term on wolverines and sagebrush lizard; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; no effect on rubber boa, amphibians, and fish. Same as alternative A.
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor to moderate, and short term on wolverines, fishers, and martens; no effect on swans, rubber boa, amphibians, and fish; no known effect on otters; adverse, minor, and short term on sagebrush lizard. May slightly increase relative to alternative A because more huts are proposed.

Mitigation

- In YNP campground use season should not be extended, and backcountry permits should not be issued to mitigate any possible impacts on grizzly bears due to the extended winter use season on the West Entrance to Old Faithful road.
- The implementation of current Bear Management Area (BMA) human use restrictions would help alleviate the risks of bear-human confrontations in spring habitats.
- Where motorized use occurs near active trumpeter swan habitats (i.e., open water), the route would be signed or plowed to prevent vehicles from stopping.
- Backcountry monitoring and administration should be implemented in GTNP. Additional area closures could be imposed if monitoring indicates such a closure was warranted for the protection of wintering bighorn sheep and moose.
- The effects of winter use on resident wolves should be monitored. Areas would be closed as necessary to protect winter and denning habitats.
- The entire length of the trail from Jackson to Moran Junction and from Moran Junction to Flagg Ranch should be patrolled to ensure that snowmobilers remain on the trail and do not illegally enter areas that are important winter range.
- The effects of the warming hut in the Two Ocean Lakes area would be monitored. If human-bear conflicts arise, close the facility.
- The use of groomed and plowed surfaces by bison and other ungulates would continue to be monitored.
- Snow track surveys for carnivores, including lynx, on both groomed and ungroomed routes would be conducted.

Effects on Natural Soundscape

Audibility Analysis — Combined Effects of All Wheeled and Oversnow Vehicles

Table 95 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet," as defined in the *Assumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: 1) audible for any amount of time (labeled "audible at all"); 2) audible for 10% of the time or more; and 3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

Alternative C features the plowed road from the West Entrance of YNP to Old Faithful, plowing from Mammoth to Madison for part of the season, snowcoach-only use from Canyon Village to Fishing Bridge for part of the season, and the addition of a new snowmobile trail in Antelope Flats in GTNP. It also requires that all snowplanes on Jackson Lake meet the current limit of 86 dBA at 50 feet.

The results for alternative C show that for the "average" background conditions, wheeled and oversnow vehicles would be audible to some degree for over 188,000 acres in the three park units. For over 80,000 of those acres, wheeled or oversnow vehicles would be audible for at least 10% of the time during the day. For over 27,000 of those acres, they would be audible for at least half of the time during the day. These acreage totals increase by 9%, 14%, and 20% for the "quiet" background conditions for the three audibility categories, respectively.

The segment from Moran Junction to the South Entrance of GTNP carries a great deal of wheeled-vehicle traffic unrelated to the alternatives and contributes the greatest to the total acreage values for all three audibility categories. These amounts remain almost constant for all the alternatives.

The plowed road from Mammoth to the Northeast Entrance is a major contributor to the "audible at all" acreage (and to a lesser extent "audible 10% or more"), which remains virtually unchanged across all the alternatives.

Other key segments for all three audibility categories are from West Thumb to Flagg Ranch, from Fishing Bridge to West Thumb, from Old Faithful to West Thumb, and from Canyon Village to Fishing Bridge, all of which increase compared to the no action alternative.

Other major segments for the "audible at all" categories are the Antelope Flats snowmobile route and Jackson Lake with its snowplanes and snowmobiles. Snowplanes and snowmobiles on Jackson Lake are also major contributors to the "audible at all" categories, although the acreage is greatly reduced over the no action alternative because of the 86 dBA limit on snowplane sound levels.

The audibility acreage is greatly reduced for the West Entrance to Madison and Madison to Old Faithful segments due to the replacement of oversnow vehicles with wheeled-vehicles on the plowed road. For YNP the 50% time audible average increases by 29% over the no action alternative for average background conditions, due largely to increased snowmobile volumes on other road segments.

Table 95. Acres of park land affected by vehicle audibility for alternative C.

Road Segment	Miles	With Average Background Conditions			With Quiet Background Conditions		
		Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
1. Mammoth to Northeast Entrance	47	16,126	5,445	0	16,822	6,342	0
2. Mammoth to Norris	21	11,400	761	0	12,372	1,043	0
3. West Entrance to Madison	14	5,260	78	0	5,555	91	0
4. Madison to Norris	14	6,748	268	0	7,142	296	0
5. Norris to Canyon Village	12	5,434	1,677	0	5,672	2,318	0
6. Canyon Village to Fishing Bridge	16	10,504	8,092	2,200	11,432	8,896	2,637
7. Fishing Bridge to East Entrance	27	12,692	5,268	0	13,744	6,588	0
8. Fishing Bridge to West Thumb	21	16,888	12,886	5,153	18,687	14,183	6,249
9. Madison to Old Faithful	16	6,157	1,660	0	6,521	1,927	0
10. Old Faithful to West Thumb	17	8,012	6,595	2,814	9,513	7,232	4,029
11. West Thumb to Flagg Ranch	24	13,788	10,767	5,133	16,018	11,989	6,931
12. Grassy Lake Road	7.6	3,033	0	0	3,303	0	0
13. Flagg Ranch to Colter Bay	15.6	7,731	3,453	0	8,443	3,859	0
14. Colter Bay to Moran Junction	10.2	4,647	2,460	0	5,040	2,694	0
15. Moran Junction to East Entrance	2	1,226	765	497	1,320	876	542
16. Moran Junction to South Entrance	26	21,714	14,812	11,293	23,842	17,207	11,996
17. Teton Park Road	15	7,805	0	0	8,512	0	0
18. Moose-Wilson Road	2.5	672	0	0	708	0	0
19. Antelope Flats Snowmobile Route	30	17,429	0	0	19,016	0	0
20. Jackson Lake	9.7	10,980	5,577	0	12,300	6,420	0
TOTAL		188,245	80,564	27,091	205,961	91,959	32,385

Average sound level analysis

To give a sense of the effect of the number of oversnow or wheeled-vehicles on a road segment, and their speed and sound level, Table 96 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain. These hourly L_{eq} values do not have the background sound level added in. Also, they cannot be compared against the background levels to assess audibility, since L_{eq} represents a long-term average of both quiet and loud moments.

The hourly L_{eq} at 100 feet are highest for the segment representing Jackson Lake, plus the YNP segments of West Thumb to Flagg Ranch, Fishing Bridge to West Thumb, Old Faithful to West Thumb, and Canyon Village to Fishing Bridge. At a distance of 4,000

feet away, these latter four segments along with the GTNP segments from Moran Junction to both the East and South Entrances have the highest L_{eq}.

There are major 16 dB to 18 dB reductions in the L_{eq} for the West Entrance to Madison and Madison to Old Faithful segments that would be plowed.

Table 96. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative C.

Road Segment	L_{eq} at Distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	46	7	45	0
3. West Entrance to Madison	36	4	34	0
4. Madison to Norris	45	6	44	0
5. Norris to Canyon Village	46	7	45	0
6. Canyon Village to Fishing Bridge	53	13	51	5
7. Fishing Bridge to East Entrance	47	7	45	0
8. Fishing Bridge to West Thumb	53	13	51	5
9. Madison to Old Faithful	38	5	36	0
10. Old Faithful to West Thumb	54	14	52	6
11. West Thumb to Flagg Ranch	54	14	52	6
12. Grassy Lake Road	42	2	41	0
13. Flagg Ranch to Colter Bay	44	7	42	0
14. Colter Bay to Moran Junction	45	9	43	1
15. Moran Junction to East Entrance	47	13	45	5
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	39	0	37	0
18. Moose-Wilson Road	27	0	25	0
19. Antelope Flats Snowmobile Route	39	0	37	0
20. Jackson Lake	54	8	52	0

Conclusion

Alternative C impacts about 104% of the acreage impacted by the no action alternative for the “audible at all” categories. The alternative impacts about 86% for the “audible 10% of the time or more” categories. For the “audible 50% or more” categories, the acreage are 115% and 122% higher than for the no action alternative (for the “average” and “quiet” backgrounds, respectively)

The increase in acreage for the “audible 50% of the time or more” categories relative to the no action alternative come from increases on the YNP segments of West Thumb to Flagg Ranch, Fishing Bridge to West Thumb, Old Faithful to West Thumb, and Canyon

Village to Fishing Bridge. These increases override the decreases on the plowed road segments from the West Entrance of YNP to Old Faithful.

Effects on Cultural Resources

The effects on cultural resources would be the same as those described in alternative B.

Conclusion

None of the actions described would adversely affect cultural resources.

Effects on Visitor Access and Circulation

Access

This alternative is similar to alternative B, except that the shuttle system is not a feature. Without the shuttle system, this alternative substantially reduces access to the park from 840 daily weekend visitors in February to about 220 given the same private vehicle access to Old Faithful described in alternative B. Roadway segments between Mammoth and Madison would be plowed from mid-February to mid-March, providing private vehicle access to the Norris destination area. Travel on these segments would be limited to traffic passing through the park, as private vehicle parking at Norris would be limited to 120 spaces (about 50% of summer season capacity).

Actions associated with this alternative that affect GTNP access include plowing the Moose-Wilson Road and maintaining a continuous snowmobile trail parallel to roadways on the eastern edge of the park between Jackson and Moran Junction, providing a connection to the CDST. Demand estimates are not available for this new snowmobile trail, but it is believed that many snowmobile enthusiasts would take advantage of this new regional access route to GTNP and the CDST. This alternative would not alter current park circulation patterns. Wheeled-vehicle circulation also would be enhanced through this alternative by providing continuous access along Moose-Wilson Road.

Closing YNP's West Entrance to oversnow access could enhance the importance of access for snowmobiles through GTNP and the Parkway to YNP. Winter scenery and wildlife in YNP will continue to attract potential visitors. Access for the number of snowmobile and snowcoach visitors currently using the West Entrance could shift to the South Entrance. The staging for oversnow opportunities from these routes could increase use at Flagg Ranch. Table 97 depicts reasonably foreseeable distribution of vehicle use under alternative C. It shows a loss of 554 snowmobile trips from West Yellowstone to Madison and 489 from Madison to Old Faithful. There would be a net decrease of 20% in snowmobile vehicle-miles traveled in the three park units and a net increase of 17% wheeled-vehicle-miles traveled. Snowcoach miles traveled would decrease by 42%.

Table 97. Alternative C motorized use.

Road Segment	Average Daily Vehicle Use January-February				
	Autos	**Vans**	**Snowcoaches**	**Snowmobiles**	**Buses**
Mammoth to Northeast Entrance	No change from current condition				
Mammoth to Norris until 2/29[38]	0	0	4	56	0
West Entrance to Madison	60	10	0	0	2
Madison to Norris	0	0	4	42	0
Norris to Canyon Village until 2/29	0	0	4	56	0
Canyon Village to Fishing Bridge before 2/29	0	0	3	242	0
Fishing Bridge to East Entrance	0	0	0	67	0
Fishing Bridge to West Thumb	0	0	3	248	0
Madison to Old Faithful	91	14	0	0	2
Old Faithful to West Thumb	0	0	4	338	0
West Thumb to Flagg Ranch	0	0	4	322	0
Grassy Lake Road	No change from current condition				
Flagg Ranch to Colter Bay	No change from current condition				
Colter Bay to Moran Junction	No change from current condition				
Moran Junction to East Entrance	No change from current condition				
Moran Junction to South Entrance	No change from current condition				
Teton Park Road	No change from current condition				
Moose-Wilson Road	10	0	0	0	0
Antelope Flats Snowmobile Route	0	0	0	25	0

Concession Services

Impacts on concessions would be the same as those described in alternative B, although the late season plowing would make access from Mammoth to Madison, thence to West Yellowstone and Old Faithful, easier for concessioners and more attractive to visitors.

Conclusion

This alternative would result in major adverse impacts by closing visitor access to about 74% of the average daily weekend visitors currently entering the park through the West Entrance and West Yellowstone; a reduction from 840 daily weekend visitors currently to 220. Although plowed roads would allow for wheeled-vehicle access, the lack of available parking at Old Faithful would result in an overall reduction in daily winter visitor use. There would be minor to moderate beneficial impacts on snowmobile access (depending upon actual use) from Jackson and Dubois to GTNP and the Parkway, and north into YNP.

[38] After February 29 snowcoach only from Norris to Canyon and Fishing Bridge; road plowed from Mammoth to Madison Junction.

Effects on Visitor Experience — Yellowstone National Park

The amount and type of winter visitor opportunities offered in YNP under alternative C are provided in Table 98.

Table 98. YNP Visitor opportunities available under alternative C.

Opportunities	Miles or Areas	Increase/ Decrease	Late Season	Increase/ Decrease	Length of Season
Groomed motorized route	154	-30	111	-35.3	South Entrance Mid-December to April + 2 weeks
Groomed motorized route snowcoach only	0	0	28.8	+28.8	Mid-December to Mid-March
Groomed motorized trail	10	+10	10	+10	Mid-December to Mid-March
Plowed route	106	+30	65.3	+35.3	No fall closure + 6 weeks
Groomed nonmotorized	47	+10	55	+8	Mid-December to Mid-March
Warming huts	9	3	9	3	Mid-December to Mid-March
Backcountry	2.2 million acres	0	2.2 million acres	0	Contingent on snowfall in northern portion of park

Visitor Satisfaction and Experience

Opportunities to view wildlife. The impacts associated with this topic would be the same as alternative B, except that visitors traveling from West Yellowstone to Old Faithful would have the ability to stop at their own discretion to view wildlife.

Opportunities to view scenery. From mid-February to mid-March snow would obstruct some views along the road segments from to Mammoth to Norris, Norris to Madison, and from Madison to Old Faithful. These impacts would occur primarily in areas where steep up-slopes occur adjacent to roadways. This type of terrain occurs intermittently and generally on one side of the road for about 5 miles along the road segment from Mammoth to Norris Junction. It also occurs intermittently for about 4 miles along the road segment from Norris Junction to Madison Junction. Snow berms in this type of terrain could exceed 12 feet and would obstruct views. In areas where the terrain is open and flat, snow berms generally would be less than 6 feet (assuming an accumulation of 95 inches). Snow blowing and removal could mitigate these impacts in some areas. These impacts would vary with the time of year, the type of vehicle used and the amount of snowfall received. The impacts to viewing opportunities on the road segments from West Entrance to Madison and Madison to Old Faithful would be the same as alternative B.

Safety (the safe behavior of others). Same as alternative B, except the use of private vehicles on the roads from West Entrance to Old Faithful could increase safety problems associated with winter driving.

The late season snowcoach-only travel zone would lessen the chance for snowmobile and skier conflict resulting in fewer motor vehicle accidents in that area.

The multiple transportation modes and seasons offered in this alternative make it very complex. Visitors traveling in private cars could be unprepared to handle the harsh winter environment. Drivers could be inexperienced in winter driving or automobiles not equipped to handle winter driving conditions.

Quality of the groomed surface. Same as alternative B.

The availability of winter activities or experiences. This alternative would provide wheeled-vehicle access from West Yellowstone to Old Faithful. Unlike the shuttle system described in alternative B, this alternative allows access by private vehicle. Because the parking at Old Faithful is very limited, the actions described under this alternative would substantially limit the number of winter visitors to that area. This alternative would afford a longer use season for travelers from the West Entrance to Old Faithful by eliminating the current fall road closure.

Under this alternative, the road north of Colter Bay in GTNP would be not be plowed. This would increase the one-way, oversnow distance to Old Faithful by 20 miles. This action could make the trip to Old Faithful via the South Entrance more difficult for oversnow vehicle travelers.

In mid- to late February, the road would be plowed from Mammoth to Norris Junction and from Norris Junction to Madison Junction. Concurrent with the road plowing would be a snowcoach-only travel zone from Norris Junction to Canyon and south to Fishing Bridge. This option would provide skiers with additional winter recreation opportunities. However, one month of snowmobiling opportunities would be lost to this user group.

Although this alternative affords new opportunities, logistically there would be negative effect on the overall visitor experience. Because of the different modes of transportation required, visitors, particularly from the North Entrance, would find trip planning and implementation complex. Parking and staging area limitations at Madison and Norris Junction could further limit visitor opportunities.

Additional winter experiences would be offered by increasing the number of groomed motorized and nonmotorized trail opportunities, and by providing winter camping opportunities at Old Faithful.

Availability of information. Same as in alternative B.

Quiet and Solitude. Opportunities for quiet and solitude would increase for skiers and snowcoach riders during the late season on the road segments from Norris to Canyon and south to Fishing Bridge. If snowmachine use of the West Entrance to Madison to Old Faithful roads were to be displaced to the remainder of the park, opportunities for quiet and solitude on the east side of YNP could decrease.

Clean air. Same as no action, except on plowed road sections. Visitors to these areas would encounter improved air quality because of reduced traffic volumes and the elimination of snowmobiles on these road segments.

Conclusion

The plowing of roads proposed under this alternative would eliminate or detract from several characteristics of the winter experience for many snowmobile and snowcoach riders (about 48% of all winter visitors in 1999-2000). This would result in major adverse impacts on this user group. The creation of snow berms along plowed roadways would cause moderate adverse impacts on scenery viewing opportunities along some roadways.

The addition of motorized and nonmotorized trails would increase available winter experiences for many visitors and result in direct moderate beneficial impacts. This alternative would have moderate adverse effects on opportunities to experience solitude and quiet (except during the late season) in most of the park areas. Because of the late season and “clean and quiet” snowcoach only zone, visitors to the Canyon area would experience moderate to major beneficial improvements in opportunities to experience clean air and solitude. Opportunities to experience clean air would also improve on the roads from West Entrance to Old Faithful.

Visitors who are unable, cannot afford, or do not wish to ride a snowmobile or snowcoach would have access via private automobile to Old Faithful. Because this type of winter experience at Old Faithful has not previously been available, alternative C would result in an increase in winter opportunities for visitors in this user group (as compared to alternative A). Moderate adverse impacts would occur due to the complexity of the alternative actions and the limited parking available at Madison, Norris, and Old Faithful. Overall, few improvements to visitor experience are expected under this alternative.

Effects on Visitor Experience — Grand Teton National Park and the Parkway

The amount and type of winter visitor opportunities offered in GTNP under alternative C are provided in Table 99.

Table 99. GTNP Visitor opportunities available under alternative C.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season†
Groomed motorized route	2.1	0	December to April
Groomed motorized route, snowcoach	2.1	0	December to April
Groomed motorized trail	64.4	30.4	December to April
Plowed road	104	4	December to April
Ungroomed motorized trail or area	24	-11.6	December to April
Groomed nonmotorized	4	4	December to April
Ungroomed nonmotorized trail or area	28.4	2	December to April
Warming huts/interpretive centers	5	3	December to April

†Variable, dependent on snow conditions

Visitor Satisfaction and Experience

Opportunities to view wildlife and scenery. There would be increased opportunities to view wildlife and scenery on routes other than plowed roads for both nonmotorized users and oversnow vehicle users. Opportunities for views from plowed roads are the same as alternative A.

Safety (the safe behavior of others). The placement of the CDST on a widened highway shoulder would separate auto from snowmobile traffic and improve safety. The co-location of motorized oversnow vehicles and nonmotorized users on the same ungroomed trail corridor (Teton Park Road) would create additional problems, especially with increased use.

Quality of the groomed surface. There would be an increased number of miles of motorized groomed trails.

The availability of access to winter activities or experiences. There would be an increased number of miles of motorized and nonmotorized groomed trails, as well as additional support facilities. This would result in moderate to major beneficial improvements for persons who wish to snowmobile and snowplane.

Availability of information. The availability of information would be improved by adding new trails and warming hut facilities.

Quiet and Solitude. Opportunities for solitude and quiet forms of winter recreation would be decreased. There would be a lack of separation between motorized and nonmotorized trails throughout the park, which would affect skiers and snowshoers.

Clean air. This experiential value would be decreased from alternative A because of the co-location of motorized and nonmotorized trails, and a lack of emphasis on "clean" motorized technology. The availability of bio-based fuels and lubricants could mitigate the impact.

Conclusion

There would be major beneficial changes for visitor experience for wildlife and scenery viewing, assuming there would be no significant displacement of animals by humans. There would be minor beneficial to minor adverse changes relating to safety due to improvement of the CDST, while co-locating motorized and nonmotorized uses elsewhere. The increased availability of information and trailside facilities would result in moderate beneficial improvements to visitor experience. Opportunities to appreciate clean air would be adversely affected. Increased visitor access and improved developments under this alternative would result in a major adverse impact on opportunities to experience quiet and solitude.

IMPACTS OF IMPLEMENTING ALTERNATIVE D

Effects on the Socioeconomic Environment

Alternative D contains several provisions for relatively minor changes in trail management and grooming within YNP and GTNP. Most of these changes are unlikely to significantly impact visitor decisions on whether to visit the parks for recreation. For example, the impact on visitor expenditures from closing the Teton Park Road to motorized use would be minor since other opportunities will be made available for oversnow motorized travel. Two proposed management changes, however, have the potential to significantly impact visitation levels to the GYA and, therefore, visitor expenditures and the overall level of economic activity within the GYA. These are proposals to close the road north of Colter Bay to wheeled-vehicles and open it to snowmobiles, and to close the East Entrance access to YNP.

Regional Economy. The 1999 GYA winter visitor survey asked respondents how their visitation would be affected if the road from Colter Bay to YNP's South Entrance was not plowed, and instead was open and groomed for snowmobiles and snowcoaches. Based on analysis of the survey responses, GYA visitation by winter visitors who live outside the five-county area would be reduced by 4.4% if the road from Colter Bay to YNP's South Entrance was not plowed, and instead was open and groomed for snowmobiles and snowcoaches. Park visitors who reside outside of the five counties made up 85.9% of total sampled visitors. This estimated reduction in visitation is a net change that considers the responses of those current winter visitors who said they would visit more often if the change occurred. Also considered in the calculation were those respondents who said they would visit, but would shift their use to other areas of the GYA (for example, from park lands to national forest lands).

In addition to anticipated winter visitation reductions resulting from the proposed management change for the Colter to South Yellowstone road segment, it is assumed that the visitors who currently use the East Entrance to YNP also would no longer do so. The East Entrance to YNP is the least used winter entrance to the park. During the 1998-99 winter season, 2,955 visitors passed through the East Entrance. These visitors accounted for about 2.5% of the total winter visitation to the park. While the 1999 GYA winter visitor survey did not ask respondents how they would respond to such an East Entrance closure, it can be assumed that a 2.5% reduction in park visitation would result. The regional economic impacts of an East Entrance closure likely would be concentrated in communities nearest the East Entrance to the park, primarily Cody, Wyoming.

Using the winter survey responses and the IMPLAN input/output model, it is estimated that total economic output in the five-county area would be reduced by $1.3 million as a result of the Colter to South Yellowstone road change, and winter closure of the East Entrance to the park in alternative D. In addition it is estimated that 32 jobs within the GYA would be lost due to reduced nonresident expenditures. This is a minor negative impact in the context of the five-county economy.

Three-State Regional Economy. Overall, 65.5% of winter visitors in the GYA winter visitor survey came from outside the three-state area of Montana, Idaho, and Wyoming. Responses from this group of winter visitors indicate that there would likely be no measurable change in winter trips to the region under the alternative D closure of the Colter Bay to South Entrance road.

Minority and Low-Income Populations. It is not expected that the changes proposed under alternative D would make the park more accessible to low-income visitors. The closure of the road from Colter Bay to the South Entrance of YNP to wheeled-vehicles has the potential to limit access by lower income groups. The impact is likely to be negligible since the South Entrance itself is not a major destination.

Social Values. Most winter visitors support mechanized access to the parks. In the context of overall park access, the changes proposed in alternative D are likely to result in minor adverse impacts.

Nonmarket Values. Alternative D actions potentially would impact nonmarket values of winter visitors by reducing the number of trips taken to the parks. The estimated reduction in current winter user visitation resulting from the change in road management from Colter Bay to YNP's South Entrance and the closure of the East Entrance would reduce total net economic value associated with visitor trips to the parks.

Based on the winter visitor survey, the nonmarket value of a trip to the parks of the GYA is $91. It is estimated that park visitation would be reduced by 4.4% as a result of the change in management of the road from Colter Bay to YNP's South Entrance. Based on current winter visitation levels, a 4.4% reduction in visitation would translate into a $350,000 reduction in the aggregate nonmarket value of winter trips to the parks. In

addition a 2.5% reduction in winter trips associated with the closure of the East Entrance to YNP would lead to a $200,000 reduction in the aggregate nonmarket value of winter trips to the parks. The combined estimated loss in winter visitor net economic value is $550,000. These are minor negative impacts in the context of overall trip benefits for park visitors.

Conclusions

The alternative D management actions would have a negligible to minor impact on the five-county and three-state economies through reduced visitation and nonresident visitor expenditures. The alternative D actions would also have a minor negative impact on current total trip nonmarket visitor benefits (through reduced visitation). The changes proposed in alternative D are likely to result in minor adverse impacts on current visitors' social values.

Effects on Air Quality and Public Health

In alternative D only 10% ethanol-blend fuels and bio-based lubricants would be sold in the parks. By winter 2008-2009, only snowmachines that have been certified to meet stricter emissions standards would be allowed in the parks. Oversnow vehicle emission rates would be 40% of the baseline CO emission rate, 75% of the baseline PM_{10} rate, and 70% of the baseline hydrocarbon emission rate. Only bio-based lubricants and 10 percent ethanol fuel blends would be sold in the park.

Table 100, Table 101, and Table 102 summarize the results of CO modeling for six locations in the three parks for alternative D. Table 100 and Table 101 show the predicted maximum 1-hour average CO concentrations and the calculated maximum 8-hour average CO concentrations, respectively. The percent contribution of each vehicle type to the maximum CO concentrations also is provided in Table 102 for the six locations. Table 103 and Table 104 provide corresponding model results for PM_{10} for the same locations and conditions as CO.

Table 100. Maximum 1-hour average CO concentrations for alternative D.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	17.60	20.60	39.7
West Entrance to Madison Roadway	7.10	10.10	39.8
Old Faithful Staging Area	0.78	3.78	39.6
Flagg Ranch Staging Area	1.08	4.08	36.9
Flagg Ranch to Colter Bay Roadway	2.60	5.60	-136.4
Mammoth to NE Entrance Roadway	0.30	3.30	0

Table 101. Maximum 8-hour average CO concentrations for alternative D.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	8.28†	9.69†	39.7
West Entrance to Madison Roadway	3.34†	4.75†	39.8
Old Faithful Staging Area	0.13	1.53	39.6
Flagg Ranch Staging Area	0.18	1.59	36.9
Flagg Ranch to Colter Bay Roadway	1.22†	2.64†	-136.4
Mammoth to NE Entrance Roadway	0.14†	1.55†	0

†Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 102. Vehicle contribution to CO concentrations for alternative D.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	97.2	2.6	0	0	0.2	0	0
West Entrance to Madison Roadway	98.1	1.9	0	0	0.1	0	0
Old Faithful Staging Area	97.5	2.5	0	0	0.1	0	0
Flagg Ranch Staging Area	97.3	2.6	0	0	0.1	0	0
Flagg Ranch to Colter Bay Roadway	98.0	1.9	0	0	0.1	0	0
Mammoth to NE Entrance Roadway	0	0	26.5	66.9	0.5	0	6.1

SM=snowmobile, SC=snowcoach, AM=automobile, LT=light truck, HT=heavy truck, TB=tour bus, SV=shuttle van.

Table 103. Maximum 24-hour average PM_{10} concentrations for alternative D.

Location	24-hr Maximum Concentration (w/o Background) (µg/m^3)	24-hr Maximum Concentration (w/ Background) (µg/m^3)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	11.69†	34.69	74.1
West Entrance to Madison Roadway	2.84†	25.84	73.5
Old Faithful Staging Area	0.16	5.16	75.1
Flagg Ranch Staging Area	0.22	5.22	64.6
Flagg Ranch to Colter Bay Roadway	0.95†	5.95	0
Mammoth to NE Entrance Roadway	0.32†	5.32	0

† Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 104. Vehicle contribution to PM_{10} concentrations for alternative D.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	97.3	0.8	0	0	1.8	0	0
West Entrance to Madison Roadway	91.1	4.1	0	0	4.7	0	0
Old Faithful Staging Area	99.3	0	0	0	0.7	0	0
Flagg Ranch Staging Area	98.9	0	0	0	1.1	0	0
Flagg Ranch to Colter Bay Roadway	90.7	4.3	0	0	5.0	0	0
Mammoth to NE Entrance Roadway	0	0	22.5	46.6	26.7	0	4.2

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Visibility

The visibility assessment indicates that under this alternative, vehicular emissions would cause localized, perceptible, visibility impairment near the West Entrance and in the area around Old Faithful and Flagg Ranch. The emissions along roadway segments would not lead to perceptible visibility impairment.

Conclusion

As noted in Table 100, Table 101, and Table 103, the model predicts moderate and major beneficial impacts on CO and PM_{10} levels, respectively, relative to alternative A at the West Entrance, along the West Entrance to Madison roadway, and at the two staging areas. However, these major and moderate beneficial impacts would not be realized until winter 2008-2009 winter, except for minor benefits attributable to bio-based lubricants and ethanol fuel blends. A major adverse impact on CO concentration is predicted along the Flagg Ranch to Colter Bay roadway. This increase in CO concentration is attributable to large assumed increases in snowmobiles using this roadway; for PM_{10}, a major beneficial impact would be realized.

Effects on Public Safety

Closing the YNP East Entrance would eliminate all risks associated with avalanches and future avalanche control on Sylvan Pass to employees and the 3% of snowmachine riders who use the East Entrance each winter. More frequent grooming of the route from West Yellowstone to Old Faithful would reduce the potential for accidents that result from poor road conditions. The geographic separation of uses by area under this alternative would reduce user conflict along the roadways that provide access to different types of activities.

In GTNP and the Parkway, the development of additional ski and snowshoe trails would increase nonmotorized recreation opportunities and decrease the potential for conflicts between different types of users. Closing the road between Colter Bay and Flagg Ranch to wheeled-vehicles and allowing snowmobile use on this segment would eliminate the potential for inter-modal conflict along this stretch of the CDST. It would eliminate a

major source of winter vehicle accidents, vehicle-wildlife accidents and unsafe vehicular activity. Limiting oversnow vehicle use of Jackson Lake to snowplanes would similarly eradicate the current low potential for inter-modal conflicts on the lake. Eliminating snowmobile use of ungroomed trails would improve safety.

Conclusion

Implementation of this alternative would result in moderate beneficial short-term improvements to public safety in the three park units due to the introduction of several positive safety measures. This assumes that no additional safety risks are associated with this alternative. Impacts would affect employees and visitors.

Effects on Geothermal Features

The effect of this alternative on YNP geothermal features would be the same as described in alternative B, except for local impacts associated with Fountain Flats and Mammoth.

Grooming the Fountain Flats road for motorized use may increase the quantity of adverse impacts on geothermal resources found along this road. There may be more off-road snowmobiling in this area, which may lead to moderate long-term impacts on geothermal features. Similar impacts may occur on this area as those described under the groomed road segments of alternative A.

The effects of unrestricted backcountry use in the Mammoth area would have the same effects as alternative A.

Conclusion

Overall, there would be more benefits under this alternative as compared to alternative A, since there will be no new winter support facilities near geothermal areas. Minor adverse impacts may continue on geothermal features located along groomed roads, with minor effects on features along the Fountain Flats road and near Mammoth.

Effects on Water and Aquatic Resources

Potential pollution sources are the same as alternative A. The potential impacts along "high" risk road segments are the same as alternative A. The exception is a decrease in risk on the Canyon Village to Fishing Bridge "high" risk segment as the projected number of snowmobiles on that segment decreases.

The elimination of all vehicles would decrease the risk of water pollution along the "medium" risk Fishing Bridge to East Entrance road segment.

Increased snowmobile usage would increase the risk of water pollution along the "low" risk Flagg Ranch to Colter Bay segment. On the Teton Park Road with the elimination of all vehicles and on the Moose-Wilson Road with the prohibition of snowmobiles the risk of water pollution would decrease.

Table 105[39]. Snowmachines and associated risk levels for alternative D.

Road Segment	Risk ± Rating	Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. A*		Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. D*	
		SM	SC	SM	SC
Mammoth to Norris	Medium	641	69	641	69
West Entrance to Madison	Medium	7759	127	7759	127
Madison to Norris	High	3458	73	3458	73
Norris to Canyon Village	Low	2214	47	2214	47
Canyon Village to Fishing Bridge	High	2370	50	148	3
Fishing Bridge to East Entrance	Medium	983	0	0	0
Fishing Bridge to West Thumb	Medium	2627	55	2627	55
Madison to Old Faithful	High	7818	165	7840	160
Old Faithful to West Thumb	Medium	3560	73	3560	73
West Thumb to Flagg Ranch	Medium	4219	103	4219	103
Grassy Lake Road	High	184	0	200	0
Flagg Ranch to Colter Bay	Low	379	0	2816	64
Colter Bay to Moran Junction	High	248	0	250	0
Moran Junction to East Entrance	Medium	49	0	50	0
Teton Park Road	Low	156	0	0	0
Moose-Wilson Road	Low	6	0	0	0

Conclusion

Two stroke engines would continue to deposit pollutants into snowpack along groomed park roads in YNP and GTNP. The effect of this deposition on water quality is undetermined, but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. It is possible that accumulations of pollutants in aquatic systems may have adverse impacts on wetlands and aquatic resources downstream from high risk road segments. Oversnow vehicle use in this alternative would involve localized high risk to surface water quality, but reduced oversnow vehicle-miles traveled along high risk road segments in the three park units by about 14%. Discontinuing snowmobile use on Jackson Lake would reduce pollution sources by half into Jackson Lake. Minor to moderate long-term adverse impacts to water resources throughout GTNP and the Parkway could occur related to the increased number of winter use opportunities. Minor short-term water quality and wetland impacts could occur in streams along the eastern side of US 89/287 as a result of CDST construction.

[39] *SM = Snowmobile, SC = Snowcoach The source of pollutants is emissions from snowmobiles, which produce (conservatively) 10 times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce fewer emissions then single snowmobiles.
±High = within 100 meters of aquatic system on 76% to 100% of the road segment; Medium = within 100 meters on 51% to 75% of the road segment; Low risk segments are within 100 meters of rivers less than 50%.

Mitigation

The portions of the CDST that would deviate from the road shoulder would be designed and sited to minimize impacts on all park resources including wildlife, vegetation, and wetlands. Focused water monitoring programs should be designed and implemented to determine whether there are specific aquatic resource effects from winter recreational use. The use of bio-based fuels by NPS and the availability of fuels in gateway communities may result in a minor decrease in pollutant deposition into snow. Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation. The release of snowpack contaminants into surface water could be mitigated by disconnecting snowmelt drainages from trails used by snowmobiles. Any new or reconstructed winter use sanitary facilities would be constructed in locations and use advanced technologies to protect water resources. A focused program of monitoring would reduce the uncertainty of impacts from oversnow vehicles, and if necessary, indicate best management practices.

Effects on Wildlife

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative D YNP would groom about 217 miles, about 4 miles less than under current management. GTNP and the Parkway would groom about 36 miles, the same as current management.

In YNP closure of the East Entrance road may affect bison movements from the Pelican Valley wintering area to the Mary Mountain wintering area, and movements outside the park's east boundary. The level of effect depends on winter snow conditions and how bison maintain traditional travel routes without groomed road surfaces. In the parks as a whole, the effects are the same as those under alternative A.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause injury and death to wildlife, especially in poor lighting conditions and during snowfall, and can cause displacement from preferred habitats.

From 1989 to 1998 only one large mammal was killed by a snowmobile between Fishing Bridge and the East Entrance (Gunther et al. 1998). Collisions would decrease under alternative D because the East Entrance road in YNP would be closed, and snowmobiles would be eliminated from the 21-mile segment of GTNP Teton Park Road and from 11 miles of the Antelope Flats area, and late night motorized travel would be prohibited.

Overall, displacement resulting from these actions would be slightly lower than in alternative A for YNP and lower than in alternative B for GTNP.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, may also provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative D YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as now. GTNP and the Parkway would plow 83 miles, a decrease of 17 miles from current management.

Effects of plowed roads would be essentially the same as alternative A for YNP, and would decrease from alternative A in GTNP.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause displacement from preferred habitats and injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

Effects of plowed roads would be essentially the same as alternative A for YNP, and would decrease from alternative A in GTNP.

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative D these opportunities increase in YNP from 37 miles to 43 miles of groomed nonmotorized routes, and increase from 26 miles to 37 miles of ungroomed routes GTNP and the Parkway. Increasing these opportunities increases the potential for adverse impacts associated with them. However, the potential for impact is relatively low since most trails and routes are located in areas not presently used or preferred by ungulates. The exception to this would be short trail segments in YNP near and through geothermal areas, such as at Mammoth Hot Springs.

For all parks the level of impact is similar to alternative A.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. This alternative mitigates potential effects associated with these activities in YNP by eliminating unregulated backcountry use in winter range. Use would be limited to designated routes, and routes would only be designated in areas where ungulate needs are not of concern.

Impacts from this use in GTNP likely would increase relative to alternative A. Increased cross-country skiing and snowshoeing use would be anticipated along the Teton Park

Road, in backcountry areas west of the road, and throughout Antelope Flats because of the elimination of snowmobiles. This increased use could adversely impact ungulates and their movement, and may result in higher energy expenditures as they attempt to move away or avoid such use. Moderate to major adverse impacts on bighorn sheep would continue, as well as potential impacts on moose, elk, and bison on Blacktail Butte and Wolff Ridge.

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. This alternative proposes to add warming hut facilities at Jenny Lake.

Overall effects would be the same as alternative A because Jenny Lake is not considered ungulate winter range.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative D YNP would groom about 217 miles of road surface, about 4 miles less than under current management. GTNP and the Parkway would groom about 36 miles, the same as current management.

Impacts are generally as stated in alternative A. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of motorized use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. No collisions have occurred between oversnow motorized vehicles and federally protected species in the parks.

Closure of the East Entrance road, and elimination of 25 miles of snowmobile route would eliminate fragmentation over the entire eastern portion of YNP, allowing free movement for species that are active in the winter. Bald eagle use along the north shore of Yellowstone Lake would be undisturbed as well.

In GTNP the types of impacts for alternative D would be similar to alternatives A and B. However, snowmobiling would be eliminated in all parts of the park except along the CDST and on Grassy Lake Road west of Flagg Ranch. Any potential adverse effects associated with motorized oversnow use would decrease because of decreased opportunities. Where snowmobiling now occurs in the Antelope Flats area and along the Moose-Wilson Road southwest of Moose Junction, cross-country skiing and snowshoeing would occur. Snowmobiles would not be allowed on Jackson Lake. Current snowmobile use is low because snowmobiles tend to bog down in the snow on the lake; however, snowplanes are and would continue to be the predominant use.

Disturbance caused by snowplanes on the frozen surface of Jackson Lake would continue to cause only negligible impacts on eagles because foraging and nesting activities would be minimal before the breakup of the ice. In all park units, if monitoring indicates disturbance to bald eagles, additional closures may be enacted. Effects on federally protected species would remain at the level of negligible to minor.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). In addition similar to groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow. Under alternative D YNP would plow 76 miles of road for wheeled-vehicle access in the winter. GTNP and the Parkway would plow 83 miles, a decrease of 17 miles from current management.

Impacts are generally as stated in alternative A. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those of traffic on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause displacement from preferred habitats and injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

Impacts are generally as stated in alternative A — none to minor. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative D these opportunities increase in YNP from 37 miles to 43 miles of groomed nonmotorized routes, and increase from 26 miles to 37 miles of ungroomed routes in GTNP and the Parkway.

Potential impacts are generally as stated in alternative A — none to negligible. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and federally protected wildlife species may only occur sporadically, they may cause displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction. This alternative mitigates potential effects associated with

these activities in YNP by eliminating unregulated backcountry use in winter range. Use would be limited to designated routes.

Effects associated with backcountry use would decrease from alternative A in YNP and in GTNP and the Parkway. Impacts are generally as stated in alternative A.

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species to the presence of human food and garbage, and lead to human-wildlife conflicts. In addition increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. This alternative proposes to add warming hut facilities at Jenny Lake.

Impacts are generally as stated in alternative A — negligible to minor. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance. Impacts to bears associated with habituation to human developments and food are negligible. Under all alternatives winter wildlife-proof garbage facilities will be constructed.

Species of Special Concern

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow, inhibiting foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey, and reducing subnivian prey availability by increasing mortality of these small mammals. Under alternative D YNP would groom about 217 miles of road surface, about 4 miles less than under current management. GTNP and the Parkway would groom about 36 miles, the same as current management.

Impacts are generally as stated in alternative A — none to minor.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts to species of special concern are displacement from preferred habitats, and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare. In 10 years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998).

Impacts are generally as stated in alternative A — none to minor. If species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance. For YNP closure of the East Entrance road and elimination of 25 miles of snowmobile route would eliminate fragmentation and displacement over the entire eastern portion of YNP, allowing free movement for species that are active in the winter such as wolverines and fishers. Closure of the road will also eliminate the need for avalanche control, thus removing any potential adverse effects to wolverines. Trumpeter swan use along the north shore of Yellowstone Lake would be undisturbed as well.

See *Water and Aquatic Resources*, Chapter IV for an assessment of the impacts of exhaust on water quality in the parks.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative D YNP would plow 76 miles of road for wheeled-vehicle access in the winter, a decrease of 20 miles over current management. GTNP and the Parkway would plow 83 miles, a decrease of 17 miles from current management.

Impacts are generally as stated in alternative A. If species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of motorized use of plowed roads. The most likely impact to species of special concern is displacement from preferred habitats and mortality caused by collisions with wheeled-vehicles.

Impacts are generally as stated in alternative A — none to negligible. If species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative D, YNP increases these opportunities from 37 miles to 43 miles of groomed nonmotorized routes, and GTNP and the Parkway increase from 26 miles to 37 miles of ungroomed routes.

Impacts are as stated generally in alternative A — none to minor. Groomed trails are not in known swan habitat; therefore, no effects on swans would occur.

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Although encounters between backcountry users and species of special management concern may occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. This alternative mitigates potential effects associated with these activities in YNP by eliminating unregulated backcountry use in winter range. Use would be limited to designated routes where wildlife concerns are minimal.

Effects associated with backcountry use would decrease from alternative A in YNP, and in GTNP and the Parkway, impacts are generally as stated in alternative A.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on species of special concern are associated with increases in human activity and the subsequent disturbance and displacement of species or their prey. This alternative proposes to add warming hut facilities at Jenny Lake.

Specifically, huts located in thermally influenced ungulate winter range could displace ungulates, and thus affect bison and elk carcass availability for wolverines, fishers, and marten. Because the huts at Jenny Lake would not be located in ungulate winter range, they would not affect the availability of carrion for these species. Therefore, impacts to other species of special concern would be the same as those under alternative A.

Conclusion

Overall effects of this alternative are similar to alternative A. Reductions in oversnow travel opportunities benefit ungulates by eliminating use on the east side of YNP, and restricting oversnow travel in GTNP to groomed routes in the northern part of the park. Elimination of access from the East Entrance to Fishing Bridge eliminates other effects associated with groomed routes, including fragmentation, and displacement. Restricted backcountry travel in YNP reduces effects associated with off-trail travel. Nonmotorized opportunities would be increased and may affect ungulates in GTNP. Increased interpretive opportunities and augmented enforcement capabilities would mitigate any other impacts.

Although impacts to populations resulting from winter recreation are neither long term nor significant, impacts to individual members of the population can be important, leading to death either directly from collisions or continued harassment, or indirectly through management actions taken as a response to habituation to human presence and food. Although concerned about impacts to individuals, the NPS primarily provides for the protection of native animal populations from management actions (with the exception of federally protected species). For example, see Chapter II, NPS 77, Natural Resources Management.

Ungulates

- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects. Any effects would decrease from alternative A in YNP because the East Entrance road would be closed. Otherwise same as alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: 1) mortality caused by collisions – adverse, negligible, and short term, and 2) displacement from preferred habitats – adverse, minor to moderate, and short term. Impacts would decrease over current management due to restrictions on late night travel, the closure of the East Entrance road in YNP, and the elimination of some motorized oversnow routes in GTNP.
- Effects of plowed roads on: 1) habitat fragmentation – adverse, minor, and short term; and 2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects. Effects would be the same as alternative A for YNP and less than alternative A for GTNP.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, minor, and short term; and 2) displacement from preferred habitats – adverse, moderate, and long term. Effects would be the same as alternative A for YNP and less than alternative A for GTNP.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, minor, and short term. Same as alternative A for all parks.

- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible to minor, and short term in YNP (a decrease from alternative A due to the elimination of unregulated backcountry use), and adverse, minor, and short term in GTNP (an increase over alternative A). Impacts on bighorn sheep in GTNP would remain moderate to major and long term if no mitigation is applied.
- Effects of the presence and use of winter support facilities on displacement – adverse, minor, and short term. Same as alternative A.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: 1) bald eagles, grizzly bears, and wolves — no effect; and 2) lynx – adverse, negligible to major, and short term, depending upon lynx distribution and abundance in the parks. Same as alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – adverse, negligible, and short term for all species excluding the grizzly bear, which will not be active during the winter use season. Slight decrease in impact over alternative A, especially for YNP.
- Effects of plowed roads on: 1) habitat fragmentation – no effect on any of the listed species; and 2) animal movements – no known effect on any of the listed species. Same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, negligible, and short term on bald eagles and grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx; and 2) displacement from preferred habitats – adverse, negligible, and short term on bald eagles, no effect on grizzly bears; no known effect to date on wolves and lynx. Same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no effect on grizzly bears; no known effect to date on wolves and lynx. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, minor, and short term on bald eagles; adverse, negligible, and short term on grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx. In YNP effects would decrease over alternative A because of the elimination of unregulated backcountry use; in GTNP impacts would remain the same as alternative A.
- Effects of the presence and use of winter support facilities on displacement – no affect on bald eagles; adverse, negligible, and short term on grizzly bears, with mitigation; adverse, minor, and short term on wolves; lynx – adverse, negligible to major, and short term, (huts in the Jenny Lake area are in potential Canada lynx habitat). Other than lynx, effects are generally the same as alternative A.

Species of Special Concern

- Effects of groomed roads and trails on: 1) animal movements – no known effect on wolverines; adverse, negligible, and short term on fishers and martens; no effect on otters, swans, reptiles, amphibians, and fish; 2) foraging activities – adverse, negligible, and short term on marten; no effect on the other species; and 3) subnivian prey availability — adverse, negligible, and short term on marten, no effect on the other species. Same as alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect on wolverine; adverse, negligible, and short term on fishers and marten; no effect on otters, reptiles, amphibians, and fish; adverse, minor, and short term on swans. Generally the same as alternative A. The closure of the East Entrance road eliminates the need for avalanche control, which may benefit wolverines.
- Effects of plowed roads on animal movements – no known effect on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish. Same as alternative A.
- Effects of motorized use of plowed roads on displacement from preferred habitats – 1) adverse, negligible, and short term on wolverines, fishers, and martens; no effect on otters,

swans, reptiles, amphibians, and fish; and 2) mortality from collisions — adverse, negligible, short term on otters and martens; no effect to date on other species. Same as alternative A.

- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect (wolverines); no known effect (fishers, martens, and otters); adverse, minor, and short term (swans); adverse, negligible, short term (sagebrush lizard) no effect (rubber boa, amphibians, and fish). Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible, and short term on wolverines and sagebrush lizard; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; no effect on rubber boa, amphibians, and fish. Effects would decrease from alternative A in YNP, and would remain the same in GTNP.
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor, and short term on wolverines, fishers, and martens; no effect on swans, rubber boa, amphibians, and fish; no known effect on otters; adverse, minor, and short term on (sagebrush lizard). Same as alternative A.

Mitigation

- Backcountry monitoring and administration should be implemented in GTNP. Additional area closures could be imposed if monitoring indicates such a closure is warranted for the protection of wintering bighorn sheep and moose.
- Creating wildlife escape routes along winter roads may mitigate some of the impacts due to groomed road surfaces.
- Use of groomed and plowed surfaces by bison and other ungulates would continue to be monitored.
- Snow track surveys for carnivores, including lynx, on both groomed and ungroomed routes would be conducted.

Effects on Natural Soundscape

Audibility analysis — combined effects of all wheeled and oversnow vehicles

Table 106 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet," as defined in the A*ssumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: 1) audible for any amount of time (labeled "audible at all"); 2) audible for 10% of the time or more; and 3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

Alternative D features no oversnow vehicles on the road segment from Fishing Bridge to the YNP East Entrance. It eliminates snowmobiles from Teton Park Road and Jackson Lake, and eliminates wheeled-vehicles from Colter Bay to Flagg Ranch. It includes the "clean and quiet" snowmobile and snowcoach requirements based on a 60 dBA noise emission level at 50 feet (compared to 70 dBA for alternative B). It requires that all snowplanes on Jackson Lake meet the current limit of 86 dBA at 50 feet.

The results for alternative D show that for the "average" background condition, wheeled or oversnow vehicles would be audible to some degree for over 110,000 acres in the three park units. For over 52,000 of those acres, wheeled or oversnow vehicles would be

audible for at least 10% the time during the day. For over 13,000 of those acres, they would be audible for at least half of the time during the day. These acreage totals increase by 8%, 19%, and 11% for the "quiet" background conditions for the three audibility categories, respectively.

The 60-dB "clean and quiet" requirement results in major reductions in audibility acreage over all segments that carry oversnow vehicles. These reductions are less evident when looking at the totals because of large contribution from wheeled-vehicle use on the segment from Moran Junction to the South Entrance of GTNP for all three audibility categories. This contribution is almost constant for all of the alternatives. For example, over 80% of the acreage for the "audible 50% or more" categories is along this segment.

The plowed road from Mammoth to the YNP Northeast Entrance is a major contributor to the "audible at all" acreage (and to a lesser extent "audible 10% or more"), which remains virtually unchanged across all alternatives.

The other key segments for the "audible 50% or more" categories are from the YNP West Entrance to Madison; from Madison to Old Faithful; and from Moran Junction to GTNP's East Entrance. However, the acreage amounts are significantly lower than for the no action alternative. The acreage along the segments from West Entrance to Old Faithful is higher than for alternative B because of the use of wheeled-vehicles only for alternative B.

Snowplanes on Jackson Lake are also major contributors to the "audible at all" categories, although the acreage is greatly reduced over the no action alternative because of the sound level restriction.

The audibility acreage is reduced to zero for Teton Park Road, but is only slightly reduced along the Flagg Ranch-Colter Bay segment.

Table 106. Acres of park land affected by vehicle audibility for alternative D.

Road Segment	(Miles)	With Average Background Conditions			With Quiet Background Conditions		
		Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More	Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More
1. Mammoth to Northeast Entrance	47	16,126	5,445	0	16,822	6,342	0
2. Mammoth to Norris	21	6,302	0	0	6,733	0	0
3. West Entrance to Madison	14	4,598	3,290	1,493	5,040	3,811	2,006
4. Madison to Norris	14	4,103	2,647	0	4,447	3,128	0
5. Norris to Canyon Village	12	3,419	1,437	0	3,719	1,905	0
6. Canyon Village to Fishing Bridge	16	5,181	2,558	0	5,568	3,033	0
7. Fishing Bridge to East Entrance	27	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
8. Fishing Bridge to West Thumb	21	7,454	4,186	0	7,931	4,731	0
9. Madison to Old Faithful	16	5,211	3,576	305	5,719	4,182	563
10. Old Faithful to West Thumb	17	4,844	2,796	0	5,268	3,322	0
11. West Thumb to Flagg Ranch	24	7,263	3,089	0	7,839	3,923	0
12. Grassy Lake Road	7.6	1,649	0	0	1,860	0	0
13. Flagg Ranch to Colter Bay	15.6	5,450	3,018	0	5,784	3,490	0
14. Colter Bay to Moran Junction	10.2	4,582	2,236	0	4,929	2,431	0
15. Moran Junction to East Entrance	2	1,193	707	474	1,294	774	517
16. Moran Junction to South Entrance	26	21,714	14,462	11,120	23,842	16,827	11,823
17. Teton Park Road	15	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	2.5	672	0	0	708	0	0
19. Antelope Flats Snowmobile Route	--	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	9.7	10,963	3,326	0	12,280	4,905	0
TOTAL		110,723	52,772	13,392	119,781	62,803	14,910

Average sound level analysis

To give a sense of the effect of the number of oversnow or wheeled-vehicles on a road segment, and their speed and sound level, Table 107 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain. These hourly L_{eq} values do not have the background sound level added in to them. Also they cannot be compared against the background levels to assess audibility, since L_{eq} represents a long-term average of both quiet and loud moments.

The hourly L_{eq} values at 100 feet are highest for Jackson Lake and from Moran Junction to the South Entrance of GTNP. These segments also have the highest L_{eq} at a distance of 4,000 feet away. However, all segments with oversnow vehicles other than Jackson Lake have a major 12 dB to 13 dB reduction in the hourly L_{eq} compared to the no action

alternative. This is due to the 60 dBA limit on the snowmobile and snowcoach noise emission levels.

Table 107. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative D.

Road Segment	L_{eq} at Distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	31	0	29	0
3. West Entrance to Madison	43	9	42	1
4. Madison to Norris	39	6	38	0
5. Norris to Canyon Village	38	4	37	0
6. Canyon Village to Fishing Bridge	37	3	36	0
7. Fishing Bridge to East Entrance	No Veh.	No Veh.	No Veh.	No Veh.
8. Fishing Bridge to West Thumb	37	3	35	0
9. Madison to Old Faithful	42	9	41	1
10. Old Faithful to West Thumb	39	5	37	0
11. West Thumb to Flagg Ranch	38	4	37	0
12. Grassy Lake Road	29	0	28	0
13. Flagg Ranch to Colter Bay	38	4	37	0
14. Colter Bay to Moran Junction	40	8	39	0
15. Moran Junction to East Entrance	45	12	43	4
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	28	0	26	0
19. Antelope Flats Snowmobile Route	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	54	7	52	0

Conclusion

Alternative D impacts about 57% to 61% of the acreage impacted by the no action alternative for the three audibility categories. These percentages are the smallest of all alternatives for the "audible at all" and "audible 10% or more" categories. For the "audible 50% or more" category, they are the second smallest, being just slightly greater than alternative G.

These large reductions are due to the required use of "clean and quiet" snowmobiles and snowcoaches on all oversnow routes, and also due to the closing of the Fishing Bridge to East Entrance and Teton Park Road segments. The reductions occur despite very little change for the main contributor to the total acreage – the through traffic on US 26 the Moran Junction to GTNP South Entrance segment.

The contribution to the L_{eq} is also reduced significantly due to 60-dB "clean and quiet" snowmobiles and snowcoaches. It is reduced to zero decibels for those road segments where all vehicular travel would be eliminated.

Effects on Cultural Resources

The effects on cultural resources would be the same as described in alternative B.

Conclusion

None of the actions described would adversely impact cultural resources.

Effects on Visitor Access and Circulation

Yellowstone National Park. Visitor access to park resources would be changed by closing roadway segment 8 between Fishing Bridge and the East Entrance. Average winter season activity at the East Entrance is about 4,100 winter use visitors. Snowmobile passengers account for 85% of this use while almost all the remaining winter use visitors entering the park through the East Entrance enjoy cross-country skiing. Of the winter season average park visitation, activity at the East Entrance Station accounts for about 3%. It is likely that these 4,100 visitors would use other recreation areas outside the park, and would not travel to other park entrances.

Grand Teton National Park and the Parkway. Under this alternative Highway 89/287, which currently provides wheeled-vehicle access to Flagg Ranch from both the south and east, would be closed to wheeled-vehicles north of Colter Bay Village. As a mitigating action, staging facilities at Flagg Ranch would be shifted to Colter Bay, providing the same services at the new location. Lodging facilities and recreation at the Flagg Ranch area would be maintained. Parking availability at Colter Bay exceeds that at Flagg Ranch, resulting in no restrictions on current activity levels or in access to park resources in YNP or GTNP. However, additional oversnow travel time would be required from Colter Bay to the South Entrance of YNP.

Oversnow motorized opportunities would be limited to the CDST, Grassy Lake Road, and the frozen surface of Jackson Lake. Alternative oversnow motorized opportunities would not be provided in other areas of the park. Wheeled-vehicles access would be eliminated between Colter Bay and Flagg Ranch. Nonmotorized circulation would be enhanced along Teton Park Road between Jenny Lake and Signal Mountain. Overall access would not be restricted by this alternative, as all areas of the park would remain accessible through alternative modes of transportation.

A reasonably foreseeable distribution of vehicle use under this alternative is depicted in the following table. It shows an average loss of 36.4 snowmobile trips daily from Fishing Bridge to the East Entrance. There would be a net decrease of 2% in snowmobile vehicle-miles traveled in the three park units and a net decrease of 2% wheeled-vehicle-miles traveled. Snowcoach miles traveled would increase by less than 2%.

Table 108. Alternative D motorized use.

Road Segment	*Average Daily Vehicle Use January-February*				
	Autos	**Vans**	**Snowcoaches**	**Snowmobiles**	**Buses**
Mammoth to Northeast Entrance	No change from current condition				
Mammoth to Norris	No change from current condition				
West Entrance to Madison	No change from current condition				
Madison to Norris	No change from current condition				
Norris to Canyon Village	No change from current condition				
Canyon Village to Fishing Bridge	No change from current condition				
Fishing Bridge to East Entrance	0	0	0	0	0
Fishing Bridge to West Thumb	No change from current condition				
Madison to Old Faithful	No change from current condition				
Old Faithful to West Thumb	No change from current condition				
West Thumb to Flagg Ranch	No change from current condition				
Grassy Lake Road	No change from current condition				
Flagg Ranch to Colter Bay	0	0	4	176	1
Colter Bay to Moran Junction	No change from current condition				
Moran Junction to East Entrance	No change from current condition				
Moran Junction to South Entrance	No change from current condition				
Teton Park Road	0	0	0	0	0
Moose-Wilson Road	10	2	0	0	0
Antelope Flats Snowmobile Route	No change from current condition				

Concession Services

Impacts would be the same as those described in alternative A. However, Pahaska Teepee, a concessioner permitted to provide guided tours into the park, would no longer be able to offer this service.

Concessions and services offered at Flagg Ranch in the Parkway, would be affected by not plowing the highway north of Colter Bay. The segment connecting Colter Bay and Flagg Ranch would be accessible via oversnow means only. Instead of wheeled-vehicle access, most employees and clients would need to travel to and from the ranch by snowmobile or snowcoach. Flagg Ranch would be snowbound, offering a more specialized experience – similar to Old Faithful. This change represents a positive effect on visitor experience or opportunities for visitors, but it would entail operational changes and higher expenses for the concession owner.

Jackson-based tour operators would need to change their operations to accommodate staging at Colter Bay, and a lengthened trip to Old Faithful. The change shortens the van trip from Jackson by 32 miles (round trip) and lengthens the snowmobile round trip by

the same distance. Some operators believe that this would make the snowmobile trip to Old Faithful too long for some clients. However, the overall length of the trip from Jackson does not change, so the van portion of the trip would be shorter and safer and the snowmobile portion would begin earlier.

The implementation of any alternative that might make substantial changes affecting a concessioner would require negotiation between the NPS and the concessioner or be deferred until a new concessions contract is awarded.

Conclusion

Winter use visitors accessing the East Entrance of YNP would experience adverse impacts with the closing of road segment 8 between the East Entrance and Fishing Bridge. However, only minor adverse impacts would occur to overall park access because the 4,100 winter visitors using the East Entrance represent only 3% of winter visitation. Most winter visitors would continue to access YNP through the entrances they currently use. Negligible adverse impacts on park access would be expected at GTNP and the Parkway because access to park resources would remain open, although the mode of transportation or time allotted for travel would change.

Effects on Visitor Experience — Yellowstone National Park

The amount and type of winter visitor opportunities offered in YNP under alternative D are provided in Table 109.

Table 109. YNP Visitor opportunities available under alternative D.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	158.6	-25.4	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Groomed motorized route snowcoach only	0	0	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Groomed motorized trail	15	+15	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Plowed route	76	0	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Groomed nonmotorized	43	+6	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Warming huts	6	0	Mid-December to Mid-March	Late night closure 11 P.M. to 5 A.M.
Backcountry	2.2 mm acres	Use restricted in 700,000 acres	Travel restricted to trails in important wildlife winter range	None

Visitor Satisfaction and Experience

Opportunities to view wildlife. The East Entrance road closure would eliminate wildlife viewing along that road segment, affecting the opportunities of 3% of all users.

Opportunities to view scenery. Same as no action alternative except that the East Entrance closure eliminates scenery viewing along that road segment.

Safety (the safe behavior of others). Separation of groomed ski and snowmobile trails would improve safety by decreasing user conflicts. An aggressive enforcement and information program would result in an improved understanding of appropriate winter recreation etiquette and behavior.

Quality of the groomed surface. The groomed routes from West Entrance to Madison Junction to Old Faithful would be groomed more frequently and to a higher standard under this alternative. Nighttime closure would increase the quality of the groomed surface throughout the park.

The availability of access to winter activities or experiences. This alternative provides an increase in motorized and nonmotorized trail opportunities throughout the park. Nonmotorized activities are emphasized in the north and northeast sections of the park, and motorized activities are emphasized in the west and southwest portions of the park. Separation of these uses will enhance the winter quality of the experience for both user groups.

Under alternative D the East Entrance road would be closed. This would eliminate the oversnow motorized experience for 3% of snowmobile riders who use this entrance to access the park.

Backcountry users would be restricted to designated routes in important winter range. This action would result in a higher rate of skier encounters in these areas, and limit the range of opportunities currently available to skiers.

Availability of information. This alternative would increase the number of warming huts and interpretive programs offered in the park. By providing more information about the attributes of the park that visitors value most, the winter visitor experience will be enhanced. Increased warming huts and interpretive programs would afford visitors better access to this information.

Quiet and Solitude. Because use in important wildlife winter range is restricted to designated trails, skiers may find fewer opportunities to experience solitude.

Under alternative D all oversnow vehicles would be required to meet strict sound standards. These standards would be implemented at various levels over the next 10 years. While the short-term changes in visitor experience would be minor, the long-term

goal of reducing snowmobile sound emissions to 60 dbA would moderately improve opportunities to experience quiet in YNP.

Clean air. Under alternative D all oversnow vehicles would be required to meet strict emissions standards. These standards would be implemented at various levels over the next nine years. While the short-term changes in visitor experience would be minor, the long-term goal of reducing snowmobile emissions would moderately enhance the ability to experience clean air in YNP and particularly at the West Entrance and Old Faithful.

Conclusion

Under alternative D the availability of information and safety programs would provide moderate beneficial improvements to the visitor experience. The increase in trail opportunities would provide moderate beneficial effects on all user groups.

The reduction of snowmobile emissions and sound levels would, over time, provide moderate beneficial improvements in opportunities for solitude, clean air, and natural quiet.

Effects on Visitor Experience — Grand Teton National Park and the Parkway

The amount and type of winter visitor opportunities offered in GTNP under alternative D are provided in Table 110.

Table 110. GTNP Visitor opportunities available under alternative D.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	20.3	18.2	December to April†	Late night closure
Groomed motorized route, snowcoach	20.3	18.2	December to April†	Late night closure
Groomed motorized trail	15.7	-21	December to April†	Late night closure
Plowed road	83.4	-16.6	December to April†	Late night closure
Ungroomed motorized trail or area	0	-35.6	December to April†	Late night closure
Groomed nonmotorized	0	0	December to April†	Late night closure
Ungroomed nonmotorized trail or area	37.1	10.7	December to April†	Late night closure
Warming huts/interpretive centers	5	3	December to April†	Late night closure

† Variable, dependent on snow conditions

Visitor Satisfaction and Experience

Opportunities to view wildlife. Same as in alternative B.

Opportunities to view scenery. Fewer opportunities would be provided to view scenery by auto since there would be no wheeled-vehicle access north of Colter Bay.

Safety (the safe behavior of others). Motorized and nonmotorized uses would be almost entirely separated in this alternative. The separation of snowmobiles and autos on the CDST and elimination of auto traffic north of Colter Bay on the CDST would greatly decrease the risk of motor vehicle accidents.

Quality of the groomed surface. Grooming would be enhanced on the Grassy Lake Trail. The CDST north of Colter Bay would become a highly groomed route.

The availability of access to winter activities or experiences. There would be a mixed impact under this alternative. Opportunities for use of ungroomed motor trails and open use by snowmobiles on Jackson Lake would decrease. Angling opportunities by snowmobilers would be lost. Counter to this loss would be increased opportunities for nonmotorized activities on ungroomed trails.

Availability of information. There would be increased and enhanced visitor programs, facilities, and interpretive opportunities to better meet the expectation and need for information.

Quiet and Solitude. Same as in alternative B; however, opportunities for solitude via motor access would be decreased, and opportunities for solitude via nonmotorized access would be increased.

Clean air. Same as in alternative B.

Conclusion

Alternative E would have minor to negligible adverse impacts on opportunities for visitor experience relating to wildlife and scenery viewing. There would be major beneficial changes relating to safety by separating user groups entirely within the park. Improving groomed surfaces on the CDST and Grassy Lake Road would result in a moderate beneficial effect. Under alternative D visitor access to motorized activities would decrease in the park's interior. This action would result in moderate adverse effects on users from this group. There would be a moderate beneficial impact to visitor experience due to greatly increased availability of information, interpretation, and winter programs. There would be a moderate beneficial impact relative to opportunities for quiet and solitude. Opportunities to appreciate clean air would be moderately improved. Where oversnow motorized use occurs, quiet and clean air would be facilitated by improved motorized technology.

IMPACTS OF IMPLEMENTING ALTERNATIVE E

Effects on the Socioeconomic Environment

In general alternative E is an adaptive management plan that offers no concrete policy change proposals at present. It defers any possible changes to a future time when scientific data is available upon which to base policy decisions. However, alternative E does call for the cessation of most snowmobile use in GTNP and the Parkway, except for access from Flagg Ranch on the Grassy Lake Road and towards YNP's South Entrance. The effects of these changes on the visitor expenditures are not quantifiable. In recent years about 3,600 snowmobiles used the CDST and Teton Park Road. They would be displaced, and a moderate reduction in visitor expenditures would occur. Lacking any other specific changes in park management, estimated socioeconomic impacts are the same as in alternative A, the no action alternative.

Regional Economy. No estimated impacts until future, unspecified policy changes are implemented.

Minority and Low-Income Populations. No estimated impacts until future, unspecified policy changes are implemented.

Social Values. No estimated impacts until future, unspecified policy changes are implemented.

Nonmarket Values. No estimated impacts until future, unspecified policy changes are implemented.

Conclusion

Alternative E is an adaptive management option. As such, no specific management actions are proposed at this time, and no impacts are estimated.

Air Quality and Public Health

This alternative emphasizes the protection of wildlife and other natural resources while allowing park visitors continued access to a range of winter recreation experiences. The alternative also would create an advisory committee of federal and state governmental representatives, environmental groups, and snowmobile industry experts to recommend emission and sound standards for snowmobiles and the implementation of those standards. This alternative is essentially the same as alternative A with respect to vehicle operating activities, except that snowmobiles would not operate on the Flagg Ranch to Colter Bay roadway, and bio-based lubricants and ethanol blend fuels would be sold in the park. Table 111, Table 112, and Table 113 summarize the results of CO modeling for six locations in the three parks for alternative E. Table 111 and Table 112 show the predicted maximum 1-hour average CO concentrations and the calculated maximum 8-hour average CO concentrations. The percent contribution of each vehicle type to the maximum CO concentrations also is provided in Table 113 for the six locations. Table

114 and Table 115 provide corresponding model results for PM_{10} for the same locations and conditions as those for CO.

Table 111. Maximum 1-hour average CO concentrations for alternative E.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	29.20	32.20	0
West Entrance to Madison Roadway	11.80	14.80	0
Old Faithful Staging Area	1.29	4.29	0
Flagg Ranch Staging Area	1.71	4.71	0.4
Flagg Ranch to Colter Bay Roadway	0.60	3.60	45.5
Mammoth to NE Entrance Roadway	0.30	3.30	0

Table 112. Maximum 8-hour average CO concentrations for alternative E.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	13.74†	15.15†	0
West Entrance to Madison Roadway	5.55†	6.96†	0
Old Faithful Staging Area	0.21	1.62	0
Flagg Ranch Staging Area	0.29	1.69	0.4
Flagg Ranch to Colter Bay Roadway	0.28†	1.69†	45.5
Mammoth to NE Entrance Roadway	0.14†	1.55†	0

† Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 113. Vehicle contribution to CO concentrations for alternative E.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	97.9	2.0	0	0	0.1	0	0
West Entrance to Madison Roadway	98.6	1.4	0	0	0	0	0
Old Faithful Staging Area	98.1	1.9	0	0	0	0.1	0
Flagg Ranch Staging Area	68.6	1.3	8.3	16.8	0.1	0.1	4.8
Flagg Ranch to Colter Bay Roadway	0	0	23.6	58.8	0.4	0.3	17.1
Mammoth to NE Entrance Roadway	0	0	26.5	66.9	0.6	0	6.1

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van

Table 114. Maximum 24-hour average PM_{10} concentrations for alternative E.

Location	24-hr Maximum Concentration (w/o Background) ($\mu g/m^3$)	24-hr Maximum Concentration (w/Background) ($\mu g/m^3$)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	45.19†	68.19	0
West Entrance to Madison Roadway	10.74†	33.74	0
Old Faithful Staging Area	0.64	5.64	0
Flagg Ranch Staging Area	0.60	5.60	5.1
Flagg Ranch to Colter Bay Roadway	0.32†	5.32	66.7
Mammoth to NE Entrance Roadway	0.32†	5.32	0

†Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{\wedge}0.365$ (Cooper and Alley 1990).

Table 115. Vehicle contribution to PM_{10} concentrations for alternative E.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	99.3	0.2	0	0	0.5	0	0
West Entrance to Madison Roadway	97.6	1.1	0	0	1.3	0	0
Old Faithful Staging Area	99.8	0	0	0	0.2	0	0
Flagg Ranch Staging Area	99.2	0	0	0	0.5	0.3	0
Flagg Ranch to Colter Bay Roadway	0	0	19.3	39.6	16.1	13.4	11.5
Mammoth to NE Entrance Roadway	0	0	22.5	46.6	26.7	0	4.2

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Visibility

The visibility assessment indicates that under this alternative, vehicular emissions would cause localized, perceptible, visibility impairment near in the vicinity of the West Entrance and in the area around Old Faithful and Flagg Ranch. The emissions along heavily used roadway segments may also lead to localized, perceptible, visibility impairment under certain viewing conditions.

Conclusion

As noted in Table 112, Table 113, and Table 114 the model predicts negligible, minor, and moderate beneficial impacts on CO and PM_{10} levels relative to alternative A at the West Entrance, along the West Entrance to Madison roadway, and at the two staging areas, respectively. Along the Flagg Ranch to Colter Bay roadway, moderate, and major beneficial impacts on CO and PM_{10} concentrations are predicted. These decreased concentrations are attributable to the prohibition of snowmobiles on this roadway.

Effects on Public Safety

Reducing the nighttime speed limit for oversnow travel in both parks between sunset and sunrise from 45 mph to 35 mph would reduce the potential for oversnow accidents. In the last three years in YNP, about 11% of the oversnow accidents occurred at night; 40% of these accidents involved wildlife-vehicle collisions.

This alternative allows for the closure of certain road segments if scientific study indicates that human presence or activities have detrimental effects on wildlife that cannot otherwise be mitigated. Should such closures be implemented, the potential for safety conflicts in these areas would be eliminated.

Within GTNP and the Parkway, oversnow motorized travel would be restricted to Grassy Lake Road and north of Flagg Ranch to the southern boundary of YNP. This would result in a substantial reduction of the present inter-modal accident potential within the park. Elimination of both snowmobiles and snowplanes from the surface of Jackson Lake would also eliminate the potential for inter-modal conflicts and accidents involving the failure of ice.

Conclusion

The effects of reducing oversnow nighttime speed limits would be negligible to minor in all three park units. Should roads be closed to oversnow travel because of demonstrated wildlife disturbance, the result also would be a major beneficial improvement to public safety in those areas. An overall decrease in oversnow motorized travel would result in moderate beneficial improvements in public safety in GTNP. These impacts would affect employees and visitors.

Effects on Geothermal Features

Under alternative E park roads and nonmotorized trails at Mammoth Terraces and the Lone Star Geyser Basin would be groomed. The effects of these actions on the geothermal features associated with roads and trails near destination areas would have the same impacts as those described in alternative A.

The beneficial impacts (relative to alternative A) on geothermal features from restricted backcountry use and the adaptive management provisions would be the same as those described in alternative B.

Conclusion

Under this alternative there would be major benefits to the geothermal resources in YNP as compared to no action alternative. Increased benefits would result from restricted backcountry use, scientific studies and monitoring leading to mitigation or possible closures where adverse impacts occur, and no new developments. Overall, this alternative would have a major beneficial effect on the protection of geothermal features.

Effects on Water and Aquatic Resources

Potential pollution sources are the same as described in alternative A. The potential impacts along “high” risk road segments are the same as described in alternative A, with the following exceptions. Risks of water pollution along the Canyon Village to Fishing Bridge and Colter Bay to Moran Junction “high-risk” road segments would decrease as snowmobiles decrease or are prohibited. Risk of water pollution along the “low-risk”

road segments would be decreased with the prohibition of snowmobiles (Flagg Ranch to Colter Bay Road) or elimination of all vehicles (Teton Park Road and Moose-Wilson Road).

Table 116[40]. Snowmachines and associated risk levels for alternative E.

Road Segment	Risk ± Rating	Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. A*		Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. E*	
		SM	SC	SM	SC
Mammoth to Norris	Medium	641	69	641	69
West Entrance to Madison	Medium	7,759	127	7,759	127
Madison to Norris	High	3,458	73	3,458	73
Norris to Canyon Village	Low	2,214	47	2,214	47
Canyon Village to Fishing Bridge	High	2,370	50	2,370	50
Fishing Bridge to East Entrance	Medium	983	0	983	0
Fishing Bridge to West Thumb	Medium	2,627	55	2,627	55
Madison to Old Faithful	High	7,818	165	7,818	165
Old Faithful to West Thumb	Medium	3,560	73	3,560	73
West Thumb to Flagg Ranch	Medium	4,219	103	4,219	103
Grassy Lake Road	High	184	0	200	0
Flagg Ranch to Colter Bay	Low	379	0	400	0
Colter Bay to Moran Junction	High	248	0	0	0
Moran Junction to East Entrance	Medium	49	0	0	0
Teton Park Road	Low	156	0	0	0
Moose-Wilson Road	Low	6	0	0	0

Conclusion

Two-stroke engine emissions would continue to deposit pollution into snowpack along groomed park roads in YNP and GTNP. The effect of this deposition on water quality is undetermined, but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. It is possible that accumulations of pollutants in aquatic systems may have adverse impacts on wetlands and aquatic resources downstream from high risk road segments. Continued oversnow vehicle use at current levels in YNP involves localized high risk to surface water quality along 22% of the road segments in the three park units, with the exception of the Colter Bay to Flagg Ranch segment. The risk of moderate to major adverse impacts on water quality in Jackson Lake would be eliminated. The continued use of bio-based fuels by the NPS and the availability of fuels in gateway communities may result in a minor decrease in pollutant deposition into snow.

[40] *SM = Snowmobile, SC = Snowcoach. The source of pollutants is emissions from snowmobiles, which produce (conservatively) ten times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce fewer emissions then single snowmobiles.
±High = within 100 meters of aquatic system on 76% to 100% of the road segment; Medium = within 100 meters on 51% to 75% of the road segment; Low risk segments are within 100 meters of rivers less than 50%.

Mitigation

Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation. The release of snowpack contaminants into surface water could be mitigated by disconnecting snowmelt drainages from trails used by oversnow vehicles. Any new or reconstructed winter use sanitary facilities would be constructed in locations and using advanced technologies that would protect water resources. A focused program of monitoring would reduce the uncertainty of impacts from oversnow vehicles, and if necessary, indicate best management practices.

Effects on Wildlife

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative E in GTNP, the only oversnow motorized use would occur on 8 miles of the Grassy Lake Road and 2 miles of the groomed route north of Flagg Ranch (a decrease of 26 miles). YNP would groom 221 miles, the same as under current management.

Relative to alternative A, the effects associated with packed routes would be nearly eliminated in GTNP. Effects in YNP would be the same as alternative A.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats and injury and death to wildlife, especially in poor lighting conditions and during snowfall.

Relative to alternative A, the effects associated with oversnow motorized use would be nearly eliminated in GTNP. Effects in YNP would be the same as alternative A.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, may also provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative E GTNP would plow 94 miles (6 less than currently) and YNP would plow 76 (the same as now).

Effects associated with plowed roads would be the same as in alternative A. In GTNP, highway 89/287 would continue to intersect and parallel riparian habitat between the Buffalo Fork, Snake River, and Willow Flats, although the CDST would no longer exist through the park. Moose-vehicle collisions would continue to occur each year, but would represent a negligible impact as compared to the total population in GTNP.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause displacement from preferred

habitats and injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

Effects of plowed roads would be essentially the same as alternative A.

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative E GTNP would establish 8 new miles of new nonmotorized routes, and YNP would offer 37 miles, the same as now.

In GTNP the types of impact in this alternative are similar to those described in alternative B, but at a lower magnitude. The elimination of nonmotorized routes in the Antelope Flats area would eliminate impacts on wintering elk, moose, and deer around Blacktail Butte.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry, nonmotorized use is more random and infrequent compared to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Alternative E minimizes the potential for these effects in YNP by eliminating or restricting backcountry use in important winter habitats (e.g., thermally influenced areas). Use, where permitted, would be limited to designated routes. Because winter habitats in GTNP are already closed to public access in several areas, no new restrictions on use in this park are proposed under alternative E.

Impacts related to backcountry use in alternative E would be reduced compared to current management in YNP. In GTNP moderate to major adverse impacts on bighorn sheep would continue, as well as potential impacts to moose, elk, and bison on Blacktail Butte and Wolff Ridge.

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. There are no new warming facilities proposed in this alternative.

Potential impacts are generally as stated in alternative A — minor.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative E in GTNP, the only oversnow motorized use would occur on 8 miles of the Grassy Lake Road and on 2 miles of the groomed route north of

Flagg Ranch (a decrease of 26 miles). YNP would groom 221 miles, the same as under current management.

Relative to alternative A, the effects associated with packed routes would be nearly eliminated in GTNP. Effects in YNP would be the same as alternative A.

Effects of motorized use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. No collisions have occurred between oversnow motorized vehicles and federally protected species in the parks.

Relative to alternative A, the effects associated with motorized use would be nearly eliminated in GTNP. Effects in YNP would be the same as alternative A.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). In addition like groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel for wildlife into areas that would normally be inaccessible due to deep snow. Under alternative E, GTNP would plow 94 miles (6 less than currently) and YNP would plow 76 (the same as currently).

Impacts are generally as stated in alternative A.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause displacement from preferred habitats and injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

Impacts are generally as stated in alternative A — none to minor. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative E, GTNP would establish 8 miles of new nonmotorized routes, and YNP would offer 37 miles, the same as currently.

Potential impacts are generally as stated in alternative A — none to negligible. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and

federally protected wildlife species may only occur sporadically, they may cause displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Alternative E minimizes the potential for these effects in YNP by eliminating or restricting backcountry use in important winter habitats (e.g., thermally influenced areas). Use, where permitted, would be limited to designated routes. Because winter habitats in GTNP are already closed to public access in several areas, no new restrictions on use in this park are proposed under this alternative.

Impacts related to backcountry use in alternative E would be reduced compared to current management in YNP. Impacts in GTNP would remain the same — negligible to minor.

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species by the presence of human food and garbage, and can lead to human-wildlife conflicts. In addition increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. There are no new warming facilities proposed in this alternative.

Potential impacts are generally as stated in alternative A — negligible to minor. If protected species activity is detected, park managers can close the area to human activity to mitigate disturbance.

Species of Special Concern

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow; inhibit foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey; and reduce subnivian prey availability by increasing mortality of these small mammals. Under alternative E in GTNP, the only oversnow motorized use would occur on 8 miles of the Grassy Lake Road and on 2 miles of the groomed route north of Flagg Ranch, and YNP would groom the same amount as currently (221 miles).

For YNP effects are generally as stated in alternative A — none to negligible. In GTNP effects associated with groomed routes would be nearly eliminated due to the closure of most packed surfaces in GTNP.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts to species of special concern are displacement from preferred habitats, and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare. In 10 years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998).

For YNP effects are generally as stated in alternative A — none to minor. In GTNP effects associated with groomed routes would be nearly eliminated due to the closure of

most of motorized trails in GTNP. If species activity is detected, park managers can close the area to human activity to prevent disturbance.

See *Water and Aquatic Resources*, Chapter IV for an assessment of the impacts of exhaust on water quality in the parks.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative E, GTNP would plow 94 miles (6 less than alternative A) and YNP would plow 76 (the same as alternative A).

Impacts are generally as stated in alternative A. If species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of motorized use of plowed roads. The most likely impact to park species of special concern is displacement from preferred habitats and mortality caused by collisions with wheeled-vehicles.

Impacts are generally as stated in alternative A. If species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. Under alternative E, GTNP would establish 8 new miles of new nonmotorized routes, and YNP would offer 37 miles, the same as now.

Impacts are as stated generally in alternative A — none to minor.

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent than nonmotorized use on designated routes. Consequently, although encounters between backcountry users and species of special management concern may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. This alternative mitigates potential effects associated with these activities in YNP by eliminating unregulated backcountry use in winter range. Use would be limited to designated routes, and routes would only be designated in areas where species' needs are not of concern.

Effects associated with backcountry use would decrease from alternative A in YNP and in GTNP and the Parkway. Impacts are generally as stated in alternative A.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on park species of special concern are associated with increases in human activity, and the subsequent disturbance and displacement of species or their prey. There are no new warming facilities proposed in this alternative. Potential impacts are

generally as stated in alternative A — none to minor. If species activity is detected, park managers can close the area to human activity to mitigate disturbance.

Conclusion

This alternative emphasizes the protection of wildlife while allowing park visitors access to a range of winter recreation opportunities. For YNP with the exception of regulated backcountry use, the effects of this alternative are generally the same as for alternative A. In GTNP all impacts associated with oversnow motorized use greatly decrease. Adaptive management requires a proactive approach to monitoring impacts on wildlife. Should it be determined that impacts are occurring contrary to regulations or management objectives, use would be restricted or eliminated. Implementation of this feature would distinguish this alternative from alternative A for YNP, by eliminating long-term effects.

Impacts to populations resulting from winter recreation are neither long-term nor significant. However, impacts to individual members of the population can lead to death, either directly from collisions or continued harassment, or indirectly through management actions taken as a response to habituation to human presence and food. Although concerned about impacts on individuals, the NPS primarily provides for the protection of native animals populations from management actions (with the exception of federally protected species). For example, see Chapter II, NPS 77, Natural Resources Management.

Ungulates

- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects. Any effects associated with groomed trails would be greatly decreased in GTNP as compared to alternative A; effects in YNP would remain the same as alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: 1) mortality caused by collisions – adverse, negligible, and short term and 2) displacement from preferred habitats – adverse, moderate, and short term. Described effects apply to YNP and are the same as alternative A; in GTNP effects would be greatly reduced as compared to alternative A.
- Effects of plowed roads on: 1) habitat fragmentation – adverse, minor, and short term; and 2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects. Same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, minor, and short term; and 2) displacement from preferred habitats – adverse, moderate, and long-term. Same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, minor, and short term. In GTNP effects would be slightly greater than alternative A, although the elimination of nonmotorized use in the Antelope Flats area would reduce disturbance to wintering ungulates. Effects in YNP would be the same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible to minor, and short term in YNP (a decrease from alternative A due to the elimination of unregulated backcountry use); and adverse, moderate, and short term in GTNP (the same as alternative A). Impacts to bighorn sheep in GTNP would remain moderate to major and long-term if no mitigation is applied.
- Effects of the presence and use of winter support facilities on displacement – adverse, minor, and short term. Same as alternative A.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: 1) bald eagles, grizzly bears, and wolves — no effect; and 2) lynx – adverse, negligible to major, and short term, depending upon lynx distribution and abundance in the parks. Described effects apply to YNP, and effects would be greatly decreased in GTNP as compared to alternative A.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – adverse, negligible, and short term for all species excluding the grizzly bear, which, for the most part, will not be active during the winter use season. Described effects apply to YNP; effects would be greatly decreased in GTNP as compared to alternative A.
- Effects of plowed roads on: 1) habitat fragmentation – no effect on any of the listed species; and 2) animal movements – no known effect on any of the listed species. Same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, negligible, and short term on bald eagles and grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx; and 2) displacement from preferred habitats – adverse, negligible, and short term on bald eagles, no effect on grizzly bears; no known effect to date on wolves and lynx. Same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no effect on grizzly bears; and no known effect to date on wolves and lynx. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, minor, and short term on bald eagles; adverse, negligible, and short term on grizzly bears; adverse, minor, and short term on wolves; and no known effect to date on lynx. Described effects apply to GTNP and are the same as alternative A; effects would decrease in YNP because of the elimination of unregulated backcountry use.
- Effects of the presence and use of winter support facilities on displacement – no affect on bald eagles; adverse, negligible, and short term on grizzly bears, with mitigation; adverse, minor, and short term on wolves; and no effect on lynx. Same as alternative A.

Species of Special Concern

- Effects of groomed roads and trails on 1) animal movements – no known effect on wolverines; adverse, negligible, and short term on fishers and martens; no effect on otters, swans, reptiles, amphibians, and fish; 2) foraging activities – adverse, negligible, and short term on marten; no effect on the other species; and 3) subnivian prey availability — adverse, negligible, and short term on marten; and no effect on the other species. Described effects apply to YNP; effects may greatly decrease relative to alternative A in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect on wolverine; adverse, negligible, and short term on fishers, marten; no effect on otters, reptiles, amphibians, and fish; and adverse, minor, and short term on swans. Described effects apply to YNP; effects may greatly decrease relative to alternative A in GTNP.
- Effects of plowed roads on animal movements – no known effect on wolverines, fishers, and martens; and no effect on otters, swans, reptiles, amphibians, and fish. Same as alternative A.
- Effects of motorized use of plowed roads on displacement from preferred habitats: 1) adverse, negligible, and short term on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish; and 2) mortality from collisions — adverse, negligible, and short term on otters, martens; and no effect to date on other species. Same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect on wolverines; no known effect on fishers, martens, and

otters; adverse, minor, and short term on swans; adverse, negligible, and short term on sagebrush lizard; and no effect on rubber boa, amphibians, and fish. Same as alternative A.

- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible, and short term on wolverines and sagebrush lizard; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; and no effect on rubber boa, amphibians, and fish. Described effects apply to GTNP and are the same as alternative A; effects would decrease in YNP because of the elimination of unregulated backcountry use.
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor, and short term on wolverines, fishers, and martens; no effect on swans, rubber boa, amphibians, and fish; no known effect on otters; and adverse, minor, and short term on sagebrush lizard. Same as alternative A.

Mitigation

- Backcountry monitoring and administration should be implemented in GTNP. Additional area closures could be imposed if monitoring indicates such a closure is warranted for the protection of wintering ungulates.
- Use of groomed and plowed surfaces by bison and other ungulates would continue to be monitored.
- Snow track surveys for carnivores, including lynx, on both groomed and ungroomed routes would be conducted.

Effects on Natural Soundscape

Audibility analysis — combined effects of all wheeled and oversnow vehicles

Table 117 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet," as defined in the *Assumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: 1) audible for any amount of time (labeled "audible at all"); 2) audible for 10% of the time or more; and 3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

Alternative E features no snowplanes or snowmobiles on Jackson Lake, and no oversnow vehicles elsewhere in GTNP except from Flagg Ranch to YNP and on Grassy Lake Road. The results for alternative E show that for the "average" background conditions, wheeled or oversnow vehicles would be audible to some degree for over 152,000 acres in the three park units. For nearly 82,000 of those acres, wheeled or oversnow vehicles would be audible for at least 10% of the time during the day. For over 23,000 of those acres, they would be audible for at least half of the time during the day. These acreages increase by 10% to 13% for the "quiet" background conditions for the three audibility categories.

Table 117. Acres of park land affected by vehicle audibility for alternative E.

Road Segment	Miles	With Average Background Conditions			With Quiet Background Conditions		
		Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More	Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More

1. Mammoth to Northeast Entrance	47	16,126	5,445	0	16,822	6,342	0
2. Mammoth to Norris	21	11,400	761	0	12,372	1,043	0
3. West Entrance to Madison	14	8,032	6,482	5,282	10,090	7,060	6,032
4. Madison to Norris	14	6,853	5,505	347	7,249	6,029	419
5. Norris to Canyon Village	12	5,443	3,955	0	5,683	4,420	0
6. Canyon Village to Fishing Bridge	16	9,999	6,559	0	11,173	7,426	166
7. Fishing Bridge to East Entrance	27	10,760	1,381	0	11,762	1,582	0
8. Fishing Bridge to West Thumb	21	15,645	9,490	0	17,785	10,884	0
9. Madison to Old Faithful	16	8,781	7,583	5,546	11,064	8,324	6,604
10. Old Faithful to West Thumb	17	7,713	6,057	0	8,053	6,647	0
11. West Thumb to Flagg Ranch	24	12,716	8,780	664	13,577	9,884	933
12. Grassy Lake Road	7.6	3,033	0	0	3,303	0	0
13. Flagg Ranch to Colter Bay	15.6	7,532	2,761	0	8,183	3,037	0
14. Colter Bay to Moran Junction	10.2	4,605	1,884	0	4,953	2,098	0
15. Moran Junction to East Entrance	2	1,193	709	476	1,294	781	519
16. Moran Junction to South Entrance	26	21,714	14,462	11,120	23,842	16,827	11,823
17. Teton Park Road	15	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	2.5	659	0	0	695	0	0
19. Antelope Flats Snowmobile Route	--	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	9.7	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
TOTAL		152,203	81,815	23,436	167,899	92,382	26,497

The segment from Moran Junction to the South Entrance of GTNP, which carries a great deal of wheeled-vehicle traffic unrelated to the alternatives, contributes the greatest to the total acreage values for all three audibility categories. These amounts remain almost constant for all the alternatives.

The plowed road from Mammoth to the YNP Northeast Entrance is a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more"), which remains virtually unchanged across all the alternatives.

The other major road segments for the "audible 50% or more" categories are from the West Entrance of YNP to Madison and from Madison to Old Faithful.

The audibility acreage is reduced to zero for Jackson Lake and Teton Park Road. There are only slight reductions for the Colter Bay to Moran Junction and Flagg Ranch to Colter Bay segments compared to the no action alternative.

Average Sound Level Analysis

To give a sense of the effect of the number of oversnow or wheeled-vehicles on a road segment, and their speed and sound level, Table 118 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and

forested terrain. These hourly L_{eq} values do not have the background sound level added in to them. Also they cannot be compared against the background levels to assess audibility, since L_{eq} represents a long-term average of both quiet and loud moments.

The hourly L_{eq} values at 100 feet are highest for West Entrance to Madison, and Madison to Old Faithful segments mentioned above. At 4,000 feet away, the L_{eq} are highest for these two segments, followed by all the YNP inner loop segments, and the segments from Moran Junction to both the East Entrance and the South Entrance of GTNP. The oversnow vehicle contributions to the L_{eq} are reduced to zero for Jackson Lake, Teton Park Road, and Antelope Flats, and there is a 7 dB reduction along the Flagg Ranch to Colter Bay segment.

Conclusion

Alternative E impacts about 84% to 86% of the acreage impacted by the no action alternative for the "audible at all" and "audible 10% of the time or more" categories. It impacts the same total acreage as the no action alternative for the "audible 50% or more" categories. The reason for the decreases in the first two categories is the elimination of oversnow vehicles on Jackson Lake and Teton Park Road in GTNP.

The contribution to the L_{eq} is reduced to zero for those road segments where vehicular travel of all types is eliminated, as well as Jackson Lake.

Table 118. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative E.

Road Segment	L_{eq} at Distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	44	4	42	0
3. West Entrance to Madison	56	16	54	8
4. Madison to Norris	53	13	51	5
5. Norris to Canyon Village	51	12	50	4
6. Canyon Village to Fishing Bridge	50	10	49	2
7. Fishing Bridge to East Entrance	44	4	43	0
8. Fishing Bridge to West Thumb	50	10	48	2
9. Madison to Old Faithful	56	16	54	8
10. Old Faithful to West Thumb	52	12	50	4
11. West Thumb to Flagg Ranch	51	11	50	3
12. Grassy Lake Road	42	2	41	0
13. Flagg Ranch to Colter Bay	37	5	36	0
14. Colter Bay to Moran Junction	40	8	38	0
15. Moran Junction to East Entrance	45	12	43	4
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	34	0	32	0
19. Antelope Flats Snowmobile Route	No. Veh	No. Veh	No. Veh	No Veh.
20. Jackson Lake	No. Veh	No. Veh	No. Veh	No Veh.

Effects on Cultural Resources

The effects on cultural resources would be the same as described in alternative B.

Conclusion

None of the actions described would adversely impact cultural resources.

Effects on Visitor Access and Circulation

Yellowstone National Park. Under alternative E access to park resources would not change unless area closures occur within the park to protect resources such as water quality, air quality, or wildlife. The effects of area closures on access would have to be evaluated in future environmental compliance documents as the closures were proposed.

Grand Teton National Park and the Parkway. The only measurable or perceptible change to access would be the elimination of the CDST along Highway 89/287 between the east park boundary and Flagg Ranch. CDST users would be shuttled from the end of

the trail to Flagg Ranch. A relatively small number of winter use visitors who use the CDST would be affected. Access to Flagg Ranch would continue. However, other modes of travel (such as wheeled-vehicles) would be used, in addition to continued oversnow access via the Grassy Lake Trail. Under alternative E, overall visitor access to park resources would not be expected to change.

Table 119 depicts reasonably foreseeable distribution of vehicle use as a consequence of this alternative. It shows a loss of 87 snowmobile trips daily from the Teton Park Road and the CDST from GTNP's East Entrance to Flagg Ranch. There would be a decrease of 2% in snowmobile vehicle-miles traveled in the three park units and a net increase of 4% wheeled-vehicle-miles traveled. Snowcoach travel would remain the same as in alternative A.

Table 119. Alternative E motorized use.

Road Segment	*Average Daily Vehicle Use January-February*				
	Autos	**Vans**	**Snowcoaches**	**Snowmobiles**	**Buses**
Mammoth to Northeast Entrance	No change from current condition				
Mammoth to Norris	No change from current condition				
West Entrance to Madison	No change from current condition				
Madison to Norris	No change from current condition				
Norris to Canyon Village	No change from current condition				
Canyon Village to Fishing Bridge	No change from current condition				
Fishing Bridge to East Entrance	No change from current condition				
Fishing Bridge to West Thumb	No change from current condition				
Madison to Old Faithful	No change from current condition				
Old Faithful to West Thumb	No change from current condition				
West Thumb to Flagg Ranch	No change from current condition				
Grassy Lake Road	No change from current condition				
Flagg Ranch to Colter Bay	86	15	0	0	1
Colter Bay to Moran Junction	192	15	0	0	1
Moran Junction to East Entrance	560	35	0	0	2
Moran Junction to South Entrance	No change from current condition				
Teton Park Road	0	0	0	0	0
Moose-Wilson Road	5	0	0	0	0
Antelope Flats Snowmobile Route	No change from current condition				

Concession Services

Impacts would essentially be the same as those described in alternative A for all three park units.

The CDST would be discontinued at the east boundary of GTNP, so snowmobilers would no longer be able to come into Flagg Ranch over the snow and from the east. The

amount of business actually provided by Flagg Ranch to such users (fuel, lodging, and groceries) is unknown, but those users are relatively few. Those snowmobilers who presently engage in this activity would have a shuttle system available to them in this alternative for transport from the east boundary to Flagg Ranch. A concession provided shuttle service may create jobs and generate some income for existing or new concessioners.

Conclusion

The short-term impact to access is negligible in YNP. However, impacts are unknown and would depend on future management decisions related to area closures. Access to resources in GTNP and the Parkway would not be expected to change, although modes of travel to those resources would change.

Effects on Visitor Experience — Yellowstone National Park

The amount and type of winter visitor opportunities offered in the YNP under alternative E are provided in Table 120.

Table 120. YNP Visitor opportunities available under alternative E.

Opportunities	Miles or Areas	Increase/ Decrease[†]	Length of Season	Other
Groomed motorized route	184	0	Mid-December to Mid-March	If scientific studies and monitoring of winter visitor use and wildlife indicate that human use or activities have a detrimental effect on wildlife that cannot be mitigated, sections of road and/or trails could be closed.
Groomed motorized route, snowcoach only	0	0	Mid-December to Mid-March	
Groomed motorized trail	0	0	Mid-December to Mid-March	
Plowed route	76	0	Mid-December to Mid-March	
Groomed nonmotorized	37	0	Mid-December to Mid-March	
Warming huts	6	0	Mid-December to Mid-March	
Backcountry	2.2 million acres	Restricted access in ~700,000 acres	Travel restricted to trails in important wildlife winter range	

[†]If scientific studies and monitoring of winter visitor use and wildlife indicate that human use or activities have a detrimental effect on wildlife that cannot be mitigated, sections of road and/or trails could be closed.

Visitor Satisfaction and Experience

Opportunities to view wildlife. Same as alternative D, except if scientific studies and monitoring related to winter wildlife and winter visitor use indicate that human presence or activities have a detrimental effect on wildlife or other park values that could not otherwise be mitigated, certain sections of roads or trails would be closed. The opportunity to view wildlife would be eliminated in areas recommended for closure.

Opportunities to view scenery. Same as alternative D, except if scientific studies and monitoring related to winter wildlife or other park values indicate that human presence or activities have a detrimental effect on wildlife that could not otherwise be mitigated, certain sections of roads or trails would be closed. The opportunity to view scenery would be eliminated in areas recommended for closure.

Safety (the safe behavior of others). Same as alternative A.

Quality of the groomed surface. Same as alternative A

The availability of access to winter activities or experiences. Backcountry users are restricted to designated routes in important winter range. This action would limit the range of opportunities currently available to skiers.

If scientific studies and monitoring related to winter wildlife and other park values indicate that human presence or activities have a detrimental effect on wildlife that could not otherwise be mitigated, certain sections of roads or trails would be closed. Recommended closures would, in the short term, eliminate access to the winter experience in those areas.

Availability of information. Same as alternative A.

Quiet and Solitude. Because use in important wildlife winter range is restricted to designated trails, skiers may find fewer opportunities to experience solitude.

Under alternative E oversnow vehicle sound standards would be established by an advisory committee. These standards would be implemented at various levels over the next 10 years. While the short-term beneficial changes in visitor experience would be minor, the long-term goal of reducing snowmobile emissions would enhance the ability to experience quiet in YNP.

Clean air. Under alternative E oversnow vehicle emission standards would be established by an advisory committee. These standards would be implemented at various levels over the next 10 years. While the short-term beneficial changes in visitor experience would be minor, the long-term goal of reducing snowmobile sound emissions would moderately enhance the ability to experience clean air in YNP.

Conclusion

The adaptive management provisions of this alternative require that if scientific studies on winter visitor use, natural resources, and other park values indicate that sections of the park must be closed to protect those values. All visitor experiences currently afforded in the closure area would be eliminated. These closure areas would result in direct major adverse impacts on desired winter visitor experience. However, long-term resource protection would provide major benefits to the protection of these experiences park-wide.

Negligible to moderate beneficial short-term improvements in opportunities to appreciate clean air, quiet, and solitude are expected from the implementation of the standards set by the advisory committee.

Effects on Visitor Experience — Grand Teton National Park and the Parkway

The amount and type of winter visitor opportunities offered in GTNP under alternative E are provided in Table 121.

Table 121. GTNP Visitor opportunities available under alternative E.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	2.1	0	December to April†	Nighttime speed limit 35 mph
Groomed motorized route, snowcoach	2.1	0	December to April†	Nighttime speed limit 35 mph
Groomed motorized trail	8	-26	December to April†	Nighttime speed limit 35 mph
Plowed road	94.4	-5.6	December to April†	Nighttime speed limit 35 mph
Ungroomed motorized trail or area	0	-35.6	December to April†	Nighttime speed limit 35 mph
Groomed nonmotorized	0	0	December to April†	Nighttime speed limit 35 mph
Ungroomed nonmotorized trail or area	35	8.6	December to April†	Nighttime speed limit 35 mph
Warming huts/interpretive centers	2	0	December to April†	

† Variable, dependent on snow conditions.

Visitor Satisfaction and Experience

Opportunities to view wildlife and scenery. There would be decreased opportunities to view wildlife and scenery via snowmobile. Opportunities would be available in the same areas by auto.

Safety (the safe behavior of others). Since the CDST would be eliminated through GTNP, any potential for motor vehicle accidents involving oversnow use of this route

also would be eliminated. The nighttime speed limit would improve safety where motorized oversnow use occurs.

Quality of the groomed surface. Grassy Lake Trail would be groomed at its present level. There would be no nonmotorized trail grooming.

The availability of access to winter activities or experiences. There would be decreased oversnow motorized access, and no oversnow linkage via CDST between trail systems to the east and YNP. Elimination of motorized use on the frozen surface of Jackson Lake would decrease the range of experiences available. A secondary impact would be loss of motorized access onto Jackson Lake for ice fishing. This opportunity would remain available for those who would use the lake surface via nonmotorized means. The loss of motorized experience on the lake would be countered by a gain in nonmotorized opportunities free of any use conflict that might ordinarily occur.

Availability of information. Same as in alternative A.

Quiet and Solitude. With the elimination of motorized use, except for Grassy Lake Trail and access north from Flagg Ranch, opportunities for quiet and solitude would be moderately enhanced for nonmotorized uses.

Clean air. With the decrease in motorized use, except for Grassy Lake Road, the major source of pollution would be eliminated.

Conclusion

Minor adverse impacts to visitor experience would occur due to fewer opportunities to view wildlife and scenery by snowmobile. The same opportunity remains for nonmotorized users and automobile occupants. There would be major beneficial changes relating to safety by eliminating snowmachines as a source of motor vehicle accidents, except on Grassy Lake Road. There would be a major adverse impact on the availability of groomed surfaces for snow-related recreation, and consequently a major adverse impact on access for a range of winter use experiences. The level and availability of winter information would not be improved from the existing condition. There would be a moderate beneficial impact relative to opportunities for quiet and solitude, other than for those who use motorized means. Opportunities to appreciate clean air would be moderately improved due to the elimination of the major source of pollution. Where oversnow motorized use remains, opportunities to experience quiet and clean air would be afforded by use of improved motorized technology.

IMPACTS OF IMPLEMENTING ALTERNATIVE F

Unless otherwise indicated, the effects of this alternative for GTNP and the Parkway are the same as indicated in alternative E. The actions proposed for GTNP and the Parkway are the same in alternatives E and F. Because YNP actions differ between these alternatives, some effects on GTNP may be different as noted in the following analysis.

Effects on the Socioeconomic Environment

GYA Regional Economy. Alternative F contains several provisions for relatively minor changes in trails management within YNP. Most of these changes are unlikely to significantly impact visitor decisions on whether to visit the parks for recreation. One proposed management change, however, has the potential to significantly impact visitation levels to the GYA and consequently, visitor expenditures and the overall level of economic activity within the GYA. Alternative F contains a proposal to close the western side of YNP to all winter travel.

The 1999 GYA winter visitor survey asked respondents how their visitation would be affected if the roads from Mammoth to Madison, West Yellowstone to Madison, and Madison to Old Faithful were closed to all vehicular travel from November 1 to April 30, and other roads were groomed for snowmobiles as they are now. Based on the responses to this survey question, visitation to the GYA by winter visitors who live outside the five counties would be reduced by 24.6% if the roads from Mammoth to West Yellowstone and to Old Faithful were closed for winter travel. It is likely that this estimate of use reduction is conservative since the question in the winter survey specified a road closure for vehicles only. To the extent that skiers and snowshoe visitors would also reduce their park visitation under this alternative, these estimates of impacts are conservative. This estimated reduction in visitation is a net change that considers the responses of those current winter visitors who said they would visit more often if the change occurred. Also considered in the calculation were those respondents who said they would visit the same, but would shift their use to other areas of the GYA (for example, from park lands to national forest lands).

Park visitors who reside outside the five counties made up 85.9% of total sampled visitors. If 24.6% of these visitors decided not to recreate within the GYA because of the west side road closure within the park, the local GYA economy would lose these potential visitors' local-area expenditures.

Based on the winter survey responses and the IMPLAN input/output model, these travel restrictions would reduce the total economic output in the five-county GYA area by an estimated $14.4 million. In addition it is estimated that 340 jobs within the five-county area would be lost due to reduced nonresident expenditures in the area.

A $14.4 million loss in output is a minor impact on the overall $5.7 billion economic output of the GYA. This impact, however, likely will be concentrated in small communities such as West Yellowstone and Gardiner, Montana. Because of the small size their economies, and proximity to the affected road segments, it can be assumed that these towns will bear a disproportionately large share of the nonresident expenditure reductions. This could have a moderate to major negative impact on the West Yellowstone and Gardiner winter economies.

The socioeconomic effects of alternative F for GTNP and the Parkway generally would be the same as alternative E. With the closure of the west side roads in YNP, some use

could shift to the Flagg Ranch area. The amount of such a shift is not quantifiable; however, visitor expenditures also would shift with use. Use levels would be limited at both these locations because of the amount of parking that is available. A moderate increase in visitor expenditures in the Jackson area may result from this shift. At other entrances, such as East and Mammoth in YNP, minor increases in use also may occur, bringing commensurate increases in visitor expenditures to communities such as Cody, Wyoming and Gardiner and Cooke City, Montana.

Three-State Regional Economy. Overall, 65.5% of winter visitors in the GYA winter visitor survey came from outside the three-state area. Responses from nonresidents indicate that there would be a 20.2% drop of nonresident winter trips to the GYA under alternative F.

A loss of the regional expenditures by these nonresidents would lead to an overall reduction of $13.7 million in total economic output and 334 jobs in the three-state area. This is a negligible to minor negative impact in the context of the regional three-state economy. This estimated reduction would be lessened if nonresidents chose to recreate at other locations within the three-state region instead of in the GYA. The extent of any such substitution behavior is unknown.

Minority and Low-Income Populations. To the extent that convenient, low-cost access is reduced by the closure of west side roads within YNP, populations living near West or East Entrances to YNP would be adversely impacted. The degree of this impact, if any, is not known at this time.

Social Values. Most current winter visitors surveyed support mechanized access to the parks. In the context of overall park access, the changes proposed in alternative F are likely to result in major adverse impacts by eliminating some of the most heavily used winter motorized routes within the parks. Conversely, a substantial portion of winter park users favor reductions in motorized use within the park. For this group the alternative F travel restrictions would have a positive impact.

Nonmarket Values. The proposed alternative F actions potentially would impact winter visitors' nonmarket values through a reduction in current winter user visitation, resulting from the closure of the west side roads.

The nonmarket value of a trip to the parks, based on the winter visitor survey is $91. It is estimated that park visitation would drop by 24.6% resulting from the park closure. Based on current winter visitation levels, a 24.6% reduction in visitation would translate into a $2 million reduction the aggregate nonmarket value of winter trips to the parks. This is a moderate negative impact.

Conclusion

Alternative F management actions would have a negligible to minor impact on the five-county and three-state economies through reduced visitation and nonresident visitor

expenditures. The reduced visitor expenditures under this alternative could have a larger, moderate to major adverse impact on the economies of small communities within the GYA such as West Yellowstone or Gardiner, Montana. The alternative F actions would also have a moderate negative impact on total current trip nonmarket visitor benefits (through reduced visitation).

Effects on Air Quality and Public Health

In alternative F the roads from the West Entrance to Madison to Old Faithful would be closed to emphasize the protection of wildlife. Winter recreation activities would focus on scenic areas in the eastern and southern portions of YNP.

Table 122, Table 123, and Table 124 summarize the results of CO modeling for six locations in the three parks for alternative F. Table 122 and Table 123 show the predicted maximum 1-hour average CO concentrations and the calculated maximum 8-hour average CO concentrations, respectively. The percent contribution of each vehicle type to the maximum CO concentrations also is provided in Table 124 for the six locations. Table 125 and Table 126 provide corresponding model results for PM_{10} for the same locations and conditions as those for CO.

Table 122. Maximum 1-hour average CO concentrations for alternative F.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	No Vehicular Traffic		
West Entrance to Madison Roadway			
Old Faithful Staging Area	1.28	4.28	0.2
Flagg Ranch Staging Area	1.74	4.74	-1.4
Flagg Ranch to Colter Bay Roadway	0.60	3.60	45.5
Mammoth to NE Entrance Roadway	0.30	3.30	0

Table 123. Maximum 8-hour average CO concentrations for alternative F.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	No Vehicular Traffic		
West Entrance to Madison Roadway			
Old Faithful Staging Area	0.21	1.62	0.2
Flagg Ranch Staging Area	0.29	1.69	-1.4
Flagg Ranch to Colter Bay Roadway	0.28†	1.69†	45.5
Mammoth to NE Entrance Roadway	0.14†	1.55†	0

† Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 124. Vehicle contribution to CO concentrations for alternative F.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	No Vehicular Traffic						
West Entrance to Madison Roadway							
Old Faithful Staging Area	98.8	1.1	0	0	0.1	0	0
Flagg Ranch Staging Area	79.4	0.8	5.7	11.3	0.1	0	2.8
Flagg Ranch to Colter Bay Roadway	0	0	25.2	59.1	0.3	0.3	15.2
Mammoth to NE Entrance Roadway	0	0	26.5	66.9	0.5	0	6.1

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Table 125. Maximum 24-hour average PM_{10} concentrations for alternative F.

Location	24-hr Maximum Concentration (w/o Background) ($\mu g/m^3$)	24-hr Maximum Concentration (w/Background) ($\mu g/m^3$)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	No Vehicular Traffic		
West Entrance to Madison Roadway			
Old Faithful Staging Area	0.64	5.64	0
Flagg Ranch Staging Area	0.71	5.71	-11.6
Flagg Ranch to Colter Bay Roadway	0.32†	5.32	66.7
Mammoth to NE Entrance Roadway	0.32†	5.32	0

† Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 126. Vehicle contribution to PM_{10} concentrations for alternative F.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	No Vehicular Traffic						
West Entrance to Madison Roadway							
Old Faithful Staging Area	99.6	0	0	0	0.4	0	0
Flagg Ranch Staging Area	99.6	0	0	0	0.3	0.2	0
Flagg Ranch to Colter Bay Roadway	0	0	21.3	41.0	14.8	12.3	10.6
Mammoth to NE Entrance Roadway	0	0	22.5	46.6	26.7	0	4.2

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Visibility

The visibility assessment indicates that under this alternative, vehicular emissions would not cause any perceptible visibility impairment near the West Entrance or along the roadways. Perceptible visibility degradation could occur near Old Faithful and Flagg Ranch when vehicles idle for extended periods.

Conclusion

As noted in Table 122, Table 123, and Table 125, the model predicts negligible beneficial and adverse impacts on CO and PM_{10}levels relative to alternative A at the Old Faithful staging area and the Flagg Ranch staging area, respectively. No results were generated for the West Entrance and along the West Entrance to Madison roadway since there would be no vehicular traffic at these locations. Relative to alternative A, this represents a major beneficial impact on CO and PM_{10} concentrations. Moderate and major beneficial impacts on CO and PM_{10} concentrations are predicted along the Flagg Ranch to Colter Bay roadway. These decreased concentrations are attributable to the prohibition of snowmobiles on this roadway.

Effects on Public Safety

Eliminating oversnow travel from sunset to sunrise would eliminate vehicular incidents during these times. Within YNP, roadway segments between West Yellowstone and Madison, Madison and Old Faithful, Madison and Norris, and Norris and Mammoth would be closed to all vehicle travel from November 1 to April 30. Closing these heavily used road segments would eliminate the potential for visitor conflicts in these areas. In the winters of 1995-1999, 71% of all reported snowmobile accidents occurred on these road segments.

Current road conditions are cited as a contributing factor in about 16% of all reported snowmobile accidents in YNP. Improved road conditions would thus be expected to decrease accident rates. Eliminating travel on a freshly groomed route allows the surface to harden and so improve its quality. Since most road grooming in YNP is performed in

the early evening, the sunset to sunrise closure would provide moderate improvements to the groomed surface quality.

Restricting all skiing activities to groomed front country trails would eliminate the risk of visitor injury or death from avalanche or exposure in backcountry areas in YNP.

Conclusion

Oversnow travel closures at night and on the most congested road segments would result in major beneficial improvements to public safety in YNP. If these closures should increase visitation to other areas of the parks, such as the Flagg Ranch to South Entrance segment (where most snowmobile accidents occur in the parkway at present), then a corresponding adverse effect on public safety would occur.

In GTNP all alternative F actions are the same as alternative E, with a negligible increase in beneficial impact due to the overall elimination of nighttime travel.

Effects on Geothermal Features

Under this alternative roads on the east side would be groomed near the following geothermal areas: West Thumb Geyser Basin, Mud Volcano, and Norris Geyser Basin. The impacts on these areas from groomed roads would be the same as described in alternative A.

Constructing a warming hut at Norris Geyser Basin would have similar impacts on this geothermal area as discussed under alternatives A and B.

There would be minor beneficial impacts on the geothermal resources with a shorter winter season (mid-December to early March) and a later spring opening in late April, since there would be less time for visitors to access geothermal features.

Visitors would not be able to access many geothermal areas due to the closures of west side park roads and the backcountry. These closures would cause major beneficial improvements to the protection of geothermal features by eliminating human access.

Conclusion

Overall human access would decrease in geothermal areas parkwide due to closures and shortened winter and spring seasons. This decrease would have major benefits to the protection of geothermal features in areas where use is eliminated, and minor benefits in areas with continued use. There may be a minor increase of visitor use to the Norris Geyser Basin because of a new warming hut. This would cause minor adverse impacts on the geothermal basin.

Effects on Water and Aquatic Resources

Potential pollution sources are the same as described in alternative A. The potential impacts along three “high” risk road segments would decrease with the elimination of all

vehicles: Madison to Norris, Madison to Old Faithful, and Colter Bay to Moran Junction road segments.

Potential impacts along the Canyon Village to Fishing Bridge "high" risk segment are expected to increase with the projected increase in snowmobile traffic.

Risks along three "medium" risk segments, Mammoth to Norris, West Entrance to Madison, and Moran Junction to East Entrance, would decrease with the prohibition of snowmobiles or all vehicles. Risks would increase along four "medium" risk segments: Fishing Bridge to East Entrance, Fishing Bridge to West Thumb, Old Faithful to West Thumb, and West Thumb to Flagg Ranch.

Risk to the "low" risk segment Norris to Canyon and Flagg Ranch would be decreased with the prohibition of snowmobiles. Risk to the "low" risk segment Flagg Ranch to Colter Bay, Teton Park Road, and Moose-Wilson Road, would be decreased with the elimination of all vehicles.

There would be no change along all other road segments.

Conclusion

Two-stroke engine emissions would continue to deposit pollution into snowpack along groomed park roads in YNP and GTNP. The effect of this deposition on water quality is undetermined, but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. It is possible that accumulations of pollutants in aquatic systems may have adverse impacts on wetlands and aquatic resources downstream from high risk road segments. Oversnow vehicle use in this alternative involves localized high risk to surface water quality. However, it reduces oversnow vehicle-miles traveled along high risk road segments in the three park units by about 74%. The risk of moderate to major adverse impacts on water quality in Jackson Lake would be eliminated.

Table 127[41]. Snowmachines and associated risk levels for alternative F.

Road Segment	Risk ± Rating	Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. A†		Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. F†	
		SM	SC	SM	SC
Mammoth to Norris	Medium	641	69	0	0
West Entrance to Madison	Medium	7759	127	0	0
Madison to Norris	High	3458	73	0	0
Norris to Canyon Village	Low	2214	47	1200	36
Canyon Village to Fishing Bridge	High	2370	50	3472	48
Fishing Bridge to East Entrance	Medium	983	0	2079	0
Fishing Bridge to West Thumb	Medium	2627	55	5019	63
Madison to Old Faithful	High	7818	165	0	0
Old Faithful to West Thumb	Medium	3560	73	5831	68
West Thumb to Flagg Ranch	Medium	4219	103	8976	96
Grassy Lake Road	High	184	0	200	0
Flagg Ranch to Colter Bay	Low	379	0	0	0
Colter Bay to Moran Junction	High	248	0	0	0
Moran Junction to East Entrance	Medium	49	0	0	0
Teton Park Road	Low	156	0	0	0
Moose-Wilson Road	Low	6	0	6	0

Mitigation

Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation. The release of snowpack contaminants into surface water could be mitigated by disconnecting snowmelt drainages from trails used by oversnow vehicles. Any new or reconstructed winter use sanitary facilities would be constructed in locations and use advanced technologies that would protect water resources. A focused program of monitoring would reduce the uncertainty of impacts from oversnow vehicles, and if necessary, indicate best management practices that might be implemented.

Effects on Wildlife

The impacts disclosed below apply to YNP. For GTNP and the Parkway, all actions and impacts associated with this alternative are the same as in alternative E, with the exception of recommended mitigation that closes Blacktail Butte and Wolff Ridge to protect moose, bison, and elk in important winter range in the park.

[41] *SM = Snowmobile, SC = Snowcoach; The source of pollutants is emissions from snowmobiles, which produce (conservatively) 10 times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce fewer emissions than single snowmobiles.
±High = within 100 meters of aquatic system on 76-100% of the road segment; Medium = within 100 on 51-75% of the road segment; Low risk segments are within 100 meters of rivers less than 50%.

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under this alternative YNP would maintain 119 miles of groomed oversnow motorized routes (a decrease of 65 miles over alternative A), and 27 miles of groomed nonmotorized routes (a decrease of 10 miles over alternative A). In addition use of the remaining available surfaces would be discontinued two weeks earlier than under current management, and oversnow travel would be prohibited from sunset to sunrise. GTNP would groom 10 miles of oversnow motorized routes (a decrease of 26 miles from alternative A).

In YNP road closure from West Entrance to Old Faithful and Mammoth to Madison Junction would eliminate all motorized use along those segments and all impacts associated with those uses. An energy efficient means for bison to move within their primary habitat and to other locations in and out of the park would be eliminated. Resulting distribution would depend on snow conditions and how bison naturally maintain traditional travel routes. Motorized use and its impacts would be eliminated in the most important ungulate habitats within YNP. The impact reduction would be proportionately greater than the reduction in miles. Consequently, the potential effects associated with this use, compared to those in alternative A, would decrease greatly.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats and injury and death for wildlife, especially in poor lighting conditions and during snowfall.

Fewer wildlife-snowmobile collisions would occur because there would be 65 fewer miles of travel surface in YNP and 62 fewer in GTNP. Closures would occur where most collisions presently occur (Gunther et al. 1998), and there would be a prohibition on travel during times when most collisions occur (dusk to dawn). The potential for impacts on ungulates would be eliminated throughout the entire western portion of the park, including the elimination of barriers to movement (fragmentation) and displacement effects. If significant numbers of snowmobiles were displaced to the east side of YNP, there could potentially be more of an impact to bison that are wintering there.

With the closures in important habitat, shortening of the winter use season, and prohibition of oversnow travel from dusk to dawn, the overall effect in YNP would be reduced to negligible and short term in this alternative.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, may also provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative F YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as under current management. GTNP would plow 94 miles, 6 miles less than now.

For both parks, the effects associated with plowed roads would be the same as alternative A.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause displacement from preferred habitats and injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

Effects of plowed roads would be essentially the same as alternative A.

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. In this alternative YNP decreases these opportunities from 37 miles to 27 miles of groomed nonmotorized routes. GTNP adds 8 miles of nonmotorized route.

Overall, any adverse effect of this use is negligible. Minor site-specific impacts are possible where trails occur in or near thermal areas. Decreasing these opportunities decreases the potential for adverse impacts associated with them. However, the potential for impact is relatively low because most trails and routes are located in areas not presently used or preferred by ungulates.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent than nonmotorized use on designated routes. Although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction.

For YNP this alternative restricts nonmotorized use to front country trails. All backcountry use is prohibited, thereby eliminating any potential effects associated with this activity and greatly decreasing effects relative to alternative A. In GTNP mitigation is recommended to prohibit public access to Blacktail Butte, Wolff Ridge, and bighorn sheep winter ranges.

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Alternative F proposes to increase the number and size of warming huts. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate or nonexistent (e.g., Tower, Norris, and Canyon). Warming huts near ungulate winter range important to elk, deer, and bison would potentially increase human use and consequently reduce habitat effectiveness. However over time, the predictable nature of the recreation

expected to occur in the area may allow species to habituate to increased human activity. The effects of these huts on ungulates would be the same for all alternatives.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under this alternative YNP would maintain 119 miles of groomed oversnow motorized routes (a decrease of 65 miles over alternative A), and 27 miles of groomed nonmotorized routes (a decrease of 10 miles over alternative A). In addition use of the remaining available surfaces would be discontinued two weeks earlier than under current management, and oversnow travel would be prohibited from sunset to sunrise. GTNP would groom 10 miles of oversnow motorized routes (a decrease of 26 miles from alternative A).

Impacts are generally as stated in alternative A — none to negligible, but may be slightly reduced. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of motorized use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. Collision impacts from snowmobiles and snowcoaches have not been documented for any of the federally protected species in the parks. Collisions would be even less likely under this alternative because there would be 65 fewer miles of travel surface in YNP and 62 fewer in GTNP. Also there would be a prohibition on travel during the times when animals are most active.

Road closure from the West Entrance to Old Faithful and Mammoth to Madison Junction would eliminate all motorized use along those segments and all impacts associated with them. The potential for impacts on federally protected species would be eliminated on the closed sections, including the elimination of barriers to movement (fragmentation) and displacement effects. Suitable habitat throughout the entire western portion of the park would be available for free movement of species active in the winter. The termination of the winter season after March 1 would minimize the potential for bear-human confrontations, and conflicts that could occur after grizzly bear emergence during spring.

Impacts are generally as stated in alternative A — none to negligible, but may be slightly reduced. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). In addition similar to groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to

deep snow. Under alternative F YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as under current management. GTNP would plow 94 miles, 6 less than currently.

For YNP the effects associated with plowed roads would be the same as alternative A. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those of traffic on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads could cause displacement from preferred habitats and injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall.

Impacts are generally as stated in alternative A – none to minor. If threatened and endangered species activity is known to occur in an area, park managers can close the area to human activity to prevent disturbance.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. In this alternative YNP decreases these opportunities from 37 miles to 27 miles of groomed nonmotorized routes. GTNP adds 8 miles over current management. Potential impacts are generally as stated in alternative A — none to negligible. If protected species activity is detected, park managers could close the area to human activity to mitigate disturbance.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Although encounters between backcountry users and federally protected wildlife species may occur sporadically, they may cause displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction. For YNP this alternative restricts nonmotorized use to front country trails thereby eliminating any potential effects associated with this activity.

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species by the presence of human food and garbage, and can lead to human-wildlife conflicts. In addition increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Alternative F proposes to increase the number and size of warming huts in YNP. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and areas where existing facility size is currently inadequate or nonexistent (e.g., Tower, Norris, and Canyon).

Potential impacts are generally as stated in alternative A — none to minor. If federally protected species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance. Construction of winter wildlife-proof garbage facilities at all major winter destination areas (a feature of all alternatives) would mitigate problems associated with habituated wildlife, including grizzly bears.

Species of Special Concern

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow, inhibiting foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey, and reducing subnivian prey availability by increasing mortality of these small mammals. Under this alternative YNP would maintain 119 miles of groomed oversnow motorized routes (a decrease of 65 miles over alternative A) and 27 miles of groomed nonmotorized routes (a decrease of 10 miles over alternative A). In addition use of the remaining available surfaces would be discontinued two weeks earlier than under current management, and oversnow travel would be prohibited from sunset to sunrise. GTNP would groom 10 miles of oversnow motorized routes (a decrease of 26 miles from alternative A).

Impacts are generally as stated in alternative A — none to negligible, but may decrease slightly.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts to park species of special concern are displacement from preferred habitats, and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare. In 10 years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998). Collision impacts would be even less likely under this alternative because there would be 65 fewer miles of travel surface in YNP and 62 fewer in GTNP. Closures would occur where most of the collisions presently occur, and there would be a prohibition on travel during times that most collisions occur.

Impacts are generally as stated in alternative A — none to minor.

If species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance. In YNP prohibition of travel from sunset to sunrise would mitigate the possible impact of vehicle collisions during times when they are more likely to occur. Road closure from West Entrance to Old Faithful and Mammoth to Madison Junction would eliminate all motorized use along those segments and all impacts associated with those uses. The potential for impacts on species of special concern would be eliminated on the closed sections, including the elimination of barriers to movement (fragmentation) and displacement effects. Suitable and effective habitat throughout the entire western portion of the park would be available for species

active in the winter. Known habitat for trumpeter swans along the Madison River would not be subject to impacts of use along the corridor.

See *Water and Aquatic Resources,* Chapter IV for an assessment of the impacts of exhaust on aquatic resources in the parks.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative F, YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as under current management. GTNP would plow 94 miles, 6 less than currently.

Impacts are generally as stated in alternative A.

Effects of motorized use of plowed roads. The most likely impact to species of special concern would be displacement from preferred habitats and mortality caused by collisions with wheeled-vehicles.

Impacts are generally as stated in alternative A — none to negligible. If species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. In this alternative YNP decreases these opportunities from 37 miles to 27 miles of groomed nonmotorized routes. GTNP would add 8 miles over current management.

Potential impacts are generally as stated in alternative A — none to minor. If protected species activity is known to occur in an area, park managers can close the area to human activity to mitigate disturbance. Groomed trails are not located swan habitat; therefore, no effects on swans would occur.

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent than nonmotorized use on designated routes. Although encounters between backcountry users and species of special management concern may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. For YNP this alternative restricts nonmotorized use to front country trails thereby eliminating any potential effects associated with this activity.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on park species of special concern are associated with increases in human activity and the subsequent disturbance and displacement of species or their prey. Alternative F proposes to increase the number and size of warming huts. Warming huts and restrooms would be located at popular ski trailheads, motorized staging areas, and

areas where existing facility size is currently inadequate or nonexistent (e.g., Tower, Norris, and Canyon).

Compared to current management, impacts related to displacement would be greater due to the increase in number of facilities. Specifically, huts located in thermally influenced ungulate winter range could displace ungulates, and thus affect bison and elk carcass availability for wolverines, fishers, and marten. Because ungulates have been known to habituate to predictable human activities, any displacement most likely would be short-term. There would be no support facilities in or near swan habitat.

Conclusion

Alternative F emphasizes wildlife protection. Consequently, many of the potential impacts to wildlife under this alternative are lower in magnitude than alternative A. Most important winter habitats are outside human-use areas, the winter use season is closed two weeks earlier than currently, and oversnow motorized travel is restricted from sunset to sunrise. Roads on the west side of YNP would not be groomed and would be closed to oversnow motorized use. Consequently, park managers could study how animals use these routes in the absence of human activity and intervention.

Impacts to populations resulting from winter recreation are neither long-term nor significant. However, impacts to individual members of the population can be important, leading to death either directly from collisions or continued harassment, or indirectly through management actions taken as a response to habituation to human presence and food. Although concerned about impacts on individuals, the NPS primarily provides for the protection of native animal populations from management actions (with the exception of federally protected species). For example, see Chapter II, NPS 77, Natural Resources Management.

Ungulates

- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects. Any effects would be greatly decreased over alternative A due to the elimination of 65 miles of groomed roads in YNP and 26 miles in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: 1) mortality caused by collisions – adverse, negligible, and short term (collision impacts are less for snowmobiles as compared to wheeled-vehicles by a factor of 10, and snowcoach collisions are rare); and 2) displacement from preferred habitats – adverse, negligible, and short term. Effects would be greatly decreased over alternative A due to the elimination of 65 miles of groomed roads in YNP and 26 miles in GTNP and the prohibition on night-time travel.
- Effects of plowed roads on: 1) habitat fragmentation – adverse, minor, and short term; and 2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects. Effects are generally the same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, minor, and short term; and 2) displacement from preferred habitats – adverse, moderate, and long term. Effects are generally the same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term. Described effect applies to

YNP, and is decreased relative to alternative A; effects in GTNP would be the same as alternative E.

- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – no effect in YNP due to the elimination of backcountry use; in GTNP, effects would be adverse, moderate, and short term (the same as alternative A).
- Effects of the presence and use of winter support facilities on displacement – adverse, minor, and short term. Effects may be slightly increased over alternative A because there are more huts proposed.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: 1) bald eagles, grizzly bears, and wolves — no effect; and 2) lynx – adverse, negligible to major, and short term, depending upon lynx distribution and abundance in the parks. Effect may decrease as compared to alternative A because the amount of groomed surface is reduced substantially.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – adverse, negligible, and short term for all species excluding the grizzly bear, which will not be active during the winter use season. Effects may decrease compared to alternative A because the amount of groomed surface use is substantially reduced, and the closure of the winter season on March 1 would help minimize potential conflicts with emerged grizzly bears.
- Effects of plowed roads on: 1) habitat fragmentation – no effect on any of the listed species; and 2) animal movements – no known effect on any of the listed species. Same as alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, negligible, and short term on bald eagles and grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx; and 2) displacement from preferred habitats – adverse, negligible, and short term on bald eagles, no effect on grizzly bears; no known effect to date on wolves and lynx. Same as alternative A. The closure of the winter season on March 1 would help to minimize potential conflicts with emerged grizzly bears.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no effect on grizzly bears; no known effect to date on wolves and lynx. Generally the same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – no effect in YNP due to the elimination of backcountry use; in GTNP, effects would generally the same as alternative A — adverse, minor, and short term on bald eagles; adverse, negligible, and short term on grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx.
- Effects of the presence and use of winter support facilities on displacement – no affect on bald eagles; adverse, negligible, and short term on grizzly bears, with mitigation; adverse, minor, and short term on wolves); effects on lynx would depend on whether or not huts are located in lynx habitat. Effects may be slightly increased over alternative A because there are more huts proposed.

Species of Special Concern

- Effects of groomed roads and trails on 1) animal movements – no known effect on wolverines; adverse, negligible, and short term on fishers and martens; no effect on otters, swans, reptiles, amphibians, and fish; 2) foraging activities – adverse, negligible, and short term on marten; no effect on the other species; and 3) subnivian prey availability — adverse, negligible, and short term on marten; no effect on the other species. Effects may decrease as compared to alternative A because the amount of groomed surface is substantially reduced.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect on wolverine; adverse, negligible, and short term on fishers and marten; no effect on otters, reptiles, amphibians, and fish; adverse, minor, and

short term on swans. Effect may decrease as compared to alternative A because the amount of groomed surface use is substantially reduced.

- Effects of plowed roads on animal movements – no known effect on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish. Same as alternative A.
- Effects of motorized use of plowed roads on displacement from preferred habitats: 1) adverse, negligible, and short term on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish; and 2) mortality from collisions — adverse, negligible, and short term on otters and martens; no effect to date on other species. Same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect on wolverines; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; adverse, negligible, and short term on sagebrush lizard no effect on rubber boa, amphibians, and fish. Generally the same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – no effect in YNP due to the elimination of backcountry use; in GTNP, effects would generally the same as alternative A – adverse, negligible, short term on wolverines, sagebrush lizard; no known effect on fishers, martens, otters; adverse, minor, short term on swans; no effect on rubber boa, amphibians, fish.
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor, and short term on wolverines, fishers, and martens; no effect on swans, rubber boa, amphibians, and fish; no known effect on otters; adverse, minor, and short term on sagebrush lizard. Effects may be slightly increased over alternative A because there are more huts proposed.

Mitigation

- Backcountry monitoring and administration should be implemented in GTNP.
- Close the south and west-facing slopes of Blacktail Butte, from the valley floor to the summit, and close all aspects of Wolff Ridge. Additional closures could be imposed if monitoring indicates such a closure is warranted to protect wintering species.
- The monitoring and evaluation of backcountry nonmotorized use in GTNP should be enhanced and closures to use should be implemented as warranted.
- Ramps or pullouts where moose could exit plowed roads to reduce collisions between snowmobiles and moose along the CDST would be provided.
- Use of groomed and plowed surfaces by bison and other ungulates would continue to be monitored.
- Snow track surveys for carnivores (including lynx) on both groomed and ungroomed routes would be conducted.
- Close important bighorn winter range in the north and south Teton Range.[42]

[42] Southern Tetons: (1) in the Prospectors Mt. and Mt. Hunt areas (including peak 10988), all areas above 3000m (9,900 ft.), and south-facing slopes on Mt. Hunt above 2600m (8,580 ft.); (2) the slopes of Static Peak above 3300m (10,890 ft.) (does not affect Albright Peak); and (3) the south-facing slopes above 3000m (9900 ft.) along the north side of Avalanche Canyon and the north fork of Avalanche Canyon.
Northern Tetons: 1) in the Ranger-Doane-Eagles Rest area (including peaks 10,298; 10,881; 10,023; 10,686), all areas above 3,000 m (9,900 ft.), and south-facing slopes of Eagles Rest above 2,600m (8,580 ft.); 2) in the Elk Mt.-Owl Peak area, all areas above 3,000 m (9,900 ft.), and south-facing slopes above 2,600m (8,580 ft.); 3) on Forellen Peak, all areas above 2,800 m (9,240 ft.) and south-facing slopes above 2,500 m (8,250 ft.); and 4) the ridgecrest and south-facing slopes of the cliffs at the mouth of Moose Creek (also known as the "Lower Berry Cliffs") above 2,300 m (7,590 ft.).

Effects on Natural Soundscape

Audibility analysis — combined effects of all wheeled and oversnow vehicles

Table 128 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet," as defined in the *Assumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: 1) audible for any amount of time (labeled "audible at all"); 2) audible for 10% of the time or more; and 3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

Alternative F features no snowplanes or snowmobiles on Jackson Lake, and no oversnow vehicles elsewhere in GTNP except from Flagg Ranch to YNP and on Grassy Lake Road. It also features no vehicles of any type on the West Entrance to Madison, Madison to Norris, Mammoth to Norris, and Madison to Old Faithful segments in YNP.

The results for alternative F show that for the "average" background conditions, wheeled or oversnow vehicles would be audible to some degree for over 122,000 acres in the three park units. For over 73,000 of those acres, wheeled or oversnow vehicles would be audible for at least 10% of the time during the day. For over 27,000 of those acres, they would be audible for at least half of the time during the day. These acreage totals increase by 10%, 13%, and 18% for the "quiet" background conditions for the three audibility categories, respectively.

The segment from Moran Junction to the South Entrance of GTNP, which carries a great deal of wheeled-vehicle traffic unrelated to the alternatives, contributes the greatest to the total acreage values for all three audibility categories. These amounts remain almost constant for all of the alternatives.

The plowed road from Mammoth to the YNP Northeast Entrance is a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more"), which remains virtually unchanged across all of the alternatives.

The YNP segments from West Thumb to Flagg Ranch, Fishing Bridge to West Thumb, Old Faithful to West Thumb, and Canyon Village to Fishing Bridge are also major contributors to the total acreage for all three audibility categories. The audibility acreage is reduced to zero for the West Entrance to Madison, Madison to Norris, Mammoth to Norris, and Madison to Old Faithful segments in YNP. For YNP as a whole, the 50% time audible acreage increases by 35% over the no action alternative for average background conditions, due to increased snowmobile volumes on the segments where they are permitted.

The audibility acreage is reduced to zero for Jackson Lake and Teton Park Road in GTNP. There are only slight reductions for the Moran Junction to Colter Bay and Flagg Ranch to Colter Bay segments compared to the no action alternative.

Table 128. Acres of park land affected by vehicle audibility for alternative F.

Road Segment	Miles	With Average Background Conditions			With Quiet Background Conditions		
		Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More	Audible at All	Audible 10% of the Time or More	Audible 50% of the Time or More
1. Mammoth to Northeast Entrance	47	16,126	5,445	0	16,822	6,342	0
2. Mammoth to Norris	21	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
3. West Entrance to Madison	14	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
4. Madison to Norris	14	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
5. Norris to Canyon Village	12	5,425	3,410	0	5,662	3,828	0
6. Canyon Village to Fishing Bridge	16	10,462	7,726	1,983	11,377	8,525	2,301
7. Fishing Bridge to East Entrance	27	12,743	5,855	0	13,800	7,092	0
8. Fishing Bridge to West Thumb	21	16,888	12,666	4,944	18,687	13,960	5,908
9. Madison to Old Faithful	16	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
10. Old Faithful to West Thumb	17	8,012	6,616	2,856	9,513	7,252	4,083
11. West Thumb to Flagg Ranch	24	13,839	11,334	6,165	16,104	12,574	7,985
12. Grassy Lake Road	7.6	3,033	0	0	3,303	0	0
13. Flagg Ranch to Colter Bay	15.6	7,659	2,822	0	8,315	3,103	0
14. Colter Bay to Moran Junction	10.2	4,607	2,239	0	4,956	2,431	0
15. Moran Junction to East Entrance	2	1,199	714	481	1,300	795	525
16. Moran Junction to South Entrance	26	21,714	14,812	11,293	23,842	17,207	11,996
17. Teton Park Road	15	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	2.5	659	0	0	695	0	0
19. Antelope Flats Snowmobile Route	30	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	9.7	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
TOTAL		122,364	73,636	27,722	134,377	83,110	32,799

Average sound level analysis

To give a sense of the effect of the number of oversnow or wheeled-vehicles on a road segment, and their speed and sound level, Table 129 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain. These hourly L_{eq} values do not have the background sound level added in to them. Also they cannot be compared against the background levels to assess audibility, since L_{eq} represents a long-term average of both quiet and loud moments.

The hourly L_{eq} at 100 feet are highest for the four above-mentioned YNP road segments. At 4,000 feet away, the L_{eq} are highest for these four segments, as well as the segments from Moran Junction to both the East Entrance and the South Entrance of GTNP. The contribution to the L_{eq} is reduced to zero for the West Entrance to Madison, Madison to Norris, Mammoth to Norris, and Madison to Old Faithful segments in YNP, and Jackson

Lake and Teton Park Road in GTNP. There is also a 6 dB reduction along the Flagg Ranch to Colter Bay segment.

Table 129. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative F.

Road Segment	L_{eq} at distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	No Veh.	No Veh.	No Veh.	No Veh.
3. West Entrance to Madison	No Veh.	No Veh.	No Veh.	No Veh.
4. Madison to Norris	No Veh.	No Veh.	No Veh.	No Veh.
5. Norris to Canyon Village	49	9	47	1
6. Canyon Village to Fishing Bridge	52	12	50	4
7. Fishing Bridge to East Entrance	48	7	46	0
8. Fishing Bridge to West Thumb	53	12	51	4
9. Madison to Old Faithful	No Veh.	No Veh.	No Veh.	No Veh.
10. Old Faithful to West Thumb	54	14	52	6
11. West Thumb to Flagg Ranch	54	14	53	6
12. Grassy Lake Road	42	2	41	0
13. Flagg Ranch to Colter Bay	38	5	36	0
14. Colter Bay to Moran Junction	40	8	39	0
15. Moran Junction to East Entrance	45	12	43	4
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	24	0	22	0
19. Antelope Flats Snowmobile Route	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	No Veh.	No Veh.	No Veh.	No Veh.

Conclusion

Alternative F impacts only about 68% of the acreage impacted by the no action alternative for the "audible at all" categories, nearly as low as alternative D. Alternative F impacts about 78% of the no action acreage for the "audible 10% of the time or more" categories, which is the third lowest amount among the alternatives. The reason for the decreases for these two sets of categories is the elimination of oversnow vehicles on six road segments in YNP and GTNP, plus Jackson Lake.

However, for the "audible 50% or more" categories, alternative F impacts 118% and 124% of the acreage for the no action alternative for "average" and "quiet" backgrounds, respectively. These increases are the highest of any of the alternatives. They are due to large amounts of acreage being added for the West Thumb to Flagg Ranch, Fishing Bridge to West Thumb, Old Faithful to West Thumb, and Canyon Village to Fishing

Bridge segments, which more than compensate for the eliminated acreage for the segments on which vehicles would be banned.

The contribution to the L_{eq} is reduced to zero for those road segments where vehicular travel of all types is eliminated, as well as Jackson Lake.

Effects on Cultural Resources

The effects on cultural resources would be the same as described in alternative B.

Conclusion

None of the actions described would adversely impact cultural resources.

Effects on Visitor Access and Circulation

Access

Yellowstone National Park. Under this alternative roadway segments between Mammoth and Madison and West Entrance to Old Faithful would be closed. An average of about 105,500 annual winter use visitors would have to choose whether to use other entrances or recreate on adjacent federal lands. Current park circulation patterns and local area access are altered by this alternative. A small number of visitors would no longer be able to complete the Grand Loop. Snowcoach tours from Mammoth and West Yellowstone would be eliminated.

Grand Teton National Park and the Parkway. Access and circulation patterns under alternatives E and F are identical within GTNP and the Parkway. However, as discussed in alternatives B and C, the closure of YNP's North and West Entrances in alternative F may affect GTNP and the Parkway. Access for all types of winter users could shift from the north and west to the south. Access for the numbers of visitors currently using the West and North Entrances could greatly increase visitation from the Jackson and Dubois portals. The staging for oversnow opportunities from these routes would increase the use of Flagg Ranch or the demand for staging there.

Table 130 depicts a reasonably foreseeable distribution of vehicle use as a consequence of this alternative. It shows a loss of 87 snowmobile trips daily from the Teton Park Road and the CDST from GTNP's East Entrance to Flagg Ranch. There would be a net change of -35% in snowmobile vehicle-miles traveled in the three park units and a net increase of 7.6% wheeled-vehicle-miles traveled. Snowcoach miles traveled would decrease by about 60%.

Table 130. Alternative F motorized use.

Road Segment	*Average Daily Vehicle Use January-February*				
	Autos	**Vans**	**Snowcoaches**	**Snowmobiles**	**Buses**
Mammoth to Northeast Entrance	No change from current condition				
Mammoth to Norris	0	0	0	0	0
West Entrance to Madison	0	0	0	0	0
Madison to Norris	0	0	0	0	0

Norris to Canyon Village	0	0	3	100	0
Canyon Village to Fishing Bridge	0	0	3	217	0
Fishing Bridge to East Entrance	0	0	0	77	0
Fishing Bridge to West Thumb	0	0	3	239	0
Madison to Old Faithful	0	0	0	0	0
Old Faithful to West Thumb	0	0	4	343	0
West Thumb to Flagg Ranch	0	0	4	374	0
Grassy Lake Road	No change from current condition				
Flagg Ranch to Colter Bay	100	15	0	0	1
Colter Bay to Moran Junction	200	15	0	0	1
Moran Junction to East Entrance	580	30	0	0	2
Moran Junction to South Entrance	No change from current condition				
Teton Park Road	0	0	0	0	0
Moose-Wilson Road	5	0	0	0	0
Antelope Flats Snowmobile Route	No change from current condition				

Concession Services

Present concessions affected in this alternative would be those permitted to run oversnow guided services from West Yellowstone into the park, from Mammoth and Gardiner into the park, and at Old Faithful. Oversnow guided tours to Old Faithful from both West Yellowstone and Mammoth/Gardiner would no longer be able to operate because those entrances to the park interior would be closed. No winter use would be allowed. This represents the greatest adverse impact on concessions relative to lost business and the need to completely change the nature of the business or the area in which it operates.

From the perspective of the operation at Old Faithful, the logistics of moving people, fuel, supplies, or garbage would remain dependent on oversnow transport. Storage of material in the park's interior would be the same as now. The difference would be the need to focus transportation needs of clientele, employees, equipment and supplies during the winter primarily from the south. This could represent a greater expense for the concession owner (a service trip from Old Faithful to Jackson would be 93 miles, oversnow and on the highway, versus 30 oversnow miles to West Yellowstone). The NPS believes that the Old Faithful experience would be even more attractive under these circumstances, and that demand for overnight stays would not decline. The time available under this alternative for business adaptation is two years, when road grooming would be terminated (winter of 2002-2003).

The implementation of any alternative that might make substantial changes affecting a concessioner would require negotiation between the NPS and the concessioner or be deferred until a new concessions contract is pending.

Concessions or services operating at other locations in the parks or from other gateways would not be affected to any great degree. Current circumstances attractive to snowmobilers entering the East Entrance to Yellowstone would change in this alternative. Snowmobilers who enjoy traveling from West Yellowstone to Pahaska Teepee (or the reverse) to stay overnight would no longer be able to. Instead they would be able to travel to Old Faithful or Flagg Ranch. This affects a small percentage of use in the parks, most often on holiday weekends. Pahaska Teepee, permitted as a snowmobile rental provider, would only marginally be affected because the opportunity to access the park from this facility remains.

The CDST would be discontinued at the east boundary of GTNP, so snowmobilers coming into Flagg Ranch over the snow and from the east would no longer be able to do so. The amount of business actually provided by Flagg Ranch to such users (fuel, lodging, and groceries) is unknown, but those users are relatively few. Those who presently engage in this opportunity would have a shuttle system (which could be concession provided) available to them in this alternative for transport from the east boundary to Flagg Ranch.

Conclusion

Because two winter entrances into YNP would be eliminated, a substantial number of winter use visitors would no longer be able to access park resources unless they chose to travel to other park entrances. Such a decision would result in a major adverse impact to current visitor access patterns at YNP. As in alternative E, access to resources in GTNP and the Parkway would not be expected to change, although modes of travel and amounts of visitation to those resources could change.

Effects on Visitor Experience — Yellowstone National Park

The amount and type of winter visitor opportunities offered in YNP under alternative F are provided in Table 131.

Table 131. YNP Visitor opportunities available under alternative F.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	119	-65	Mid-December to Early March - 2 weeks	Night closure sunrise to sunset
Groomed motorized route, snowcoach only	0	0	Mid-December to Early March - 2 weeks	Night closure sunrise to sunset
Groomed motorized trail	0	0	Mid-December to Early March - 2 weeks	Night closure sunrise to sunset
Plowed route	76	0	Mid-December to Early March - 2 weeks	Night closure sunrise to sunset
Groomed nonmotorized	27	-10	Mid-December to Early March - 2 weeks	Night closure sunrise to sunset
Warming huts	+7	+1	Mid-December to Early March - 2 weeks	Night closure sunrise to sunset
Backcountry	2.2 million acres	-2 million acres of accessible area	Backcountry closed to visitation	

Visitor Satisfaction and Experience

Opportunities to view wildlife. Under alternative F opportunities to view wildlife would be eliminated from the following road sections: Mammoth to Norris Junction, Norris Junction to Madison Junction, Madison Junction to Old Faithful, and Madison Junction to West Entrance. Currently 105,500 winter visitors use these entrances annually.

Opportunities to view wildlife from the backcountry of YNP would be eliminated under this alternative because all nonmotorized activities would be limited to front country groomed routes. See *Access to winter activities* below.

All other wildlife viewing opportunities would be the same as in alternative A.

Opportunities to view scenery. Under alternative F opportunities to view wildlife would be eliminated from the following road sections: Mammoth to Norris Junction, Norris Junction to Madison Junction, Madison Junction to Old Faithful, and Madison Junction to West Entrance.

Opportunities to view scenery from the YNP backcountry would be eliminated under this alternative. See *The availability of access to winter activities or experiences* below.

All other scenery viewing opportunities would be the same as in alternative A.

Safety (the safe behavior of others). Same as alternative A for all open road segments.

Quality of the groomed surface. If winter use increases substantially in other areas of the park, the quality of the groomed surfaces there could decrease substantially. If grooming operations begin immediately after park closure, roads would have time to refreeze resulting in an improved visitor experience.

The availability of access to winter activities or experiences. Current winter visitors entering from the West and North Entrances account for about 73% of all winter visitors. Recent survey respondents indicated that about 25% would not visit the parks if the West and North Entrances were closed. Opportunities for these visitors would either be eliminated or available at another park entrance. The Grand Loop experience for oversnow transportation would be eliminated (affecting about 10% of current day users). Visitors wishing to access Old Faithful would be required to travel additional distances (an additional 15 miles from the South Entrance). Closure of YNP from sunset to sunrise would result in additional inconvenience to paid visitors and employees. Nighttime closures would also eliminate the opportunity to dine at the Snowlodge in the evening and then access lodging outside the park.

The elimination of backcountry skiing would result in major adverse impacts on the experience of viewing wildlife and scenery for visitors in this user group (About 10% of all winter visitors to YNP (Littlejohn 1996).)

Availability of information. Same as alternative A.

Quiet and Solitude. Some improvements in snowmobile sound emissions technologies are expected. For all open areas of the park, opportunities for quiet and solitude would be the same as described in alternative A.

Clean air. Some improvements in snowmobile emissions technologies are expected. For all open areas of the park, opportunities for clean air would be the same as described in alternative A.

Conclusion

The elimination of winter opportunities on the road segments connecting the West and North Entrances with Old Faithful would result in major adverse impacts on the desired experience for current winter visitors. Other areas of the park could receive an increase in use if mitigation strategies were not implemented. If winter use increases in other areas of the parks, the result would be an increase in snowmachine emissions and a periodic loss of a clean air environment. Moderate adverse impacts would be expected on visitor experiences in those areas.

The elimination of backcountry skiing in YNP would result in major adverse impacts on the experience of viewing wildlife and scenery for these users.

Effects on Visitor Experience — Grand Teton National Park and the Parkway

The amount and type of winter visitor opportunities offered in GTNP under alternative F are provided in Table 132.

Table 132. GTNP Visitor opportunities available under alternative F.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	2.1	0	December to April†	Nighttime closure – sunset to sunrise
Groomed motorized route, snowcoach	2.1	0	December to April†	Nighttime closure – sunset to sunrise
Groomed motorized trail	8	-26	December to April†	Nighttime closure – sunset to sunrise
Plowed road	94.4	-5.6	December to April†	Nighttime closure – sunset to sunrise
Ungroomed motorized trail or area	0	-35.6	December to April†	Nighttime closure – sunset to sunrise
Groomed nonmotorized	0	0	December to April†	Nighttime closure – sunset to sunrise
Ungroomed nonmotorized trail or area	35	8.6	December to April†	Nighttime closure – sunset to sunrise
Warming huts/interpretive centers	2	0	December to April†	Nighttime closure – sunset to sunrise

† Variable, dependent on snow conditions

Visitor Satisfaction and Experience

For all the factors that are important to the experience and satisfaction of the visitor, alternative F is very nearly the same as alternative E. The exception to this is the possible redistribution of oversnow motorized use from YNP's West and North Entrances to the South and East Entrances, as described in the *Access and Circulation* section. For most of the park this is of no consequence. For the north end of the park, where snowmobile access remains along the Grassy Lake Road to Flagg Ranch, use could greatly increase. If significant numbers of people wish to experience YNP using the South Entrance there could be a net increase in use or demand at Flagg Ranch where staging would occur. The result could be an increase in snowmachine emissions and periodic losses of a clean air environment.

IMPACTS OF IMPLEMENTING ALTERNATIVE G — THE PREFERRED ALTERNATIVE

Effects on the Socioeconomic Environment

GYA Regional Economy. As with several other alternatives, alternative G contains several provisions for relatively minor changes in trail management within YNP and GTNP. Most of these changes are unlikely to substantially impact visitor decisions on whether or not to visit the parks for recreation. One proposed management change, however, has the potential to substantially impact visitation levels to the GYA and, therefore, visitor expenditures and the overall level of economic activity within the GYA. Alternative G contains a proposal to allow only oversnow mass transit vehicles (snowcoaches) that can meet strict emissions and sound requirements.

The 1999 GYA winter visitor survey asked respondents how their visitation would be affected if both YNP and GTNP were open only to snowcoach, skiing, and snowshoeing. Based on the responses to this survey question, visitation to the GYA by winter visitors who live outside the five-county area would be reduced by 33.4% if winter travel were restricted to either snowcoach or nonmotorized travel. This estimated reduction in visitation is a net change that considers the responses of those current winter visitors who said they would visit more often if the change occurred. Also considered in the calculation were those respondents who said they would visit the same, but shift their use to other areas of the GYA (for example, from park lands to national forest lands). Table 133 shows that for the largest classes of winter user groups (snowmobilers, skiers, and snowcoach riders), anticipated changes in visitation under alternative G vary dramatically. While 59.6% of those who snowmobiled on their trip said that they would visit less frequently under the alternative G changes, only 12% of skiers and 14.1% of snowcoach riders said they would visit less frequently. Conversely, while only 5.6% of snowmobilers said they would visit more frequently under this alternative, 33.7% of skiers and 22.8% of snowcoach riders said they would increase their visitation. The estimate of a 33.4% decrease in visitation to the five-county area considers the anticipated changes in visitation by these diverse groups of winter park users.

Table 133. Visitation response to alternative G changes in winter park access: by visitor category.

If YNP were open only to snowcoach, skiing, and snowshoeing.			
Response	**Snowmobile**	**Cross-Country Skiers**	**Snowcoach**
No change	17.8%	37.2%	42.5%
Would visit less frequently	59.6%	12.0%	14.1%
Would visit more frequently	5.6%	33.7%	22.8%
Would visit the same amount	4.2%	6.5%	7.8%
Not Sure	12.8%	10.7%	12.8%
Sample Size	792	247	106

In the winter visitor survey, park visitors who live outside the five-county area made up 85.9% of total sampled. If 33.4% of these visitors decided not to recreate in the GYA

because of restrictions of mechanized travel, the local economy would lose these visitors' local-area expenditures.

Based on the winter survey responses and the IMPLAN input/output model, it is estimated that these travel restrictions under alternative G would reduce the total economic output in the five-county GYA area by $19.2 million. In addition it is estimated that 454 jobs within the GYA would be lost due to reduced nonresident expenditures in the area.

While a $19.2 million loss in output is a minor impact on the $5.7 billion economic output of the GYA, this impact likely would be concentrated in small communities near the three parks. The impacts of travel restrictions under alternative G on small local economies such as West Yellowstone could be more significant. However, the correlation between West Entrance visits and the West Yellowstone economy is not as close as expected (Chapter III). Thus it is difficult to predict the actual effect of a change in park visitation on the West Yellowstone economy.

The town of West Yellowstone levies a local option tax targeted at tourist spending. Tax records show that from 1989-1999, tourist expenditures have grown at a rate of 10% annually. Tourist spending in winter accounts for about 25% of year-round tourist spending in West Yellowstone. Given the relative size of the West Yellowstone winter economy to year-round totals and the recent growth trends for tourist spending, the estimated visitation reductions associated with alternative G likely would have a moderate to major short-term negative impact on the town's winter economy, but a minor impact on the year-round economy of the town. Assuming that West Yellowstone's economy and winter park visitation are closely related, West Yellowstone's winter economy would decline about 33%, while the year-round economy would decline 8%. This decline is less than the average one-year growth rate, so even under this assumption the impact is likely to be short term. These estimates likely overstate the impacts on West Yellowstone. The impact projections assume that the change in the West Yellowstone winter economy is proportional to change in park visitation. There is considerable evidence that historical declines in winter park visitation through the West Entrance have not resulted in proportional declines in the local economy. For example, in winter 1995-96, West Entrance visitation decreased by 13.4% over the previous year, but resort tax collection increased by 9.6%. This non-proportional relationship between park visitation and the local economy is probably due to extensive winter recreational opportunities near West Yellowstone, including 400 miles of snowmobile trails outside YNP. The average visitor to West Yellowstone spends only one day of a multi-day trip snowmobiling in the park. Other factors that might impact visitation levels include snow depth, pricing policies, and advertising efforts.

The estimates of reductions in GYA visitation and nonresident expenditures are based on survey responses of current winter visitors. The 1999 YNP summer visitor survey asked respondents who had not previously visited the park in the winter whether they would

visit the park next winter if a snowcoach, ski, and snowshoe only policy were adopted. Responses from this group indicate that new winter users could be attracted to YNP as a result of the alternative. Increased visitation could serve to offset a portion of estimated visitation losses. Rather than a 33% reduction in visitation, the reduction could be around 25%. As noted by some local businesses in DEIS comments, a policy change may lead to economic diversification. Firms that lost business when snowmobiles became the dominant use may benefit from a variety of users.

Three-State Regional Economy. Overall, 65.5% of winter visitors in the GYA winter visitor survey came from outside the three-state area of Montana, Idaho, and Wyoming. Responses from these visitors indicate that nonresident winter trips to the GYA would drop by 27.8% under alternative G.

A loss of regional expenditures by these nonresidents would lead to an overall reduction of $17.7 million in total economic output and 430 jobs in the three-state area. This is a negligible, negative impact in the context of the regional three-state economy. This estimated loss would be reduced if nonresidents choose to recreate at other locations within the three-state region instead of the GYA. The extent of this estimated loss, however, is unknown.

Responses from the summer YNP visitor population survey indicate that increased interest in visiting the park in the winter months under the alternative G management policies may lead to an approximate 11% increase in winter visitation. An active public education and awareness campaign, directed at the summer visitor population, which focuses on the parks' new winter use opportunities, may partially offset the expected loss of non-resident winter users. This education and awareness campaign can operate in partnership with the parks' gateway communities, state agency cooperators, and private businesses.

Minority and Low-Income Populations. Alternative G would eliminate the primary mode of current winter access to the parks — snowmobiling. To the extent that current snowmobile visitors to the park would now use snowcoach access under alternative G, the price of snowcoach access to the park could rise, impacting low-income winter visitor access to the park.

A portion of currently operated snowcoaches would not meet the emission and sound requirements of alternative G. These older snowcoaches would either need to be replaced or eliminated ,which likely would place further upward pressure on the price of snowcoach access to the park, and would negatively impact low-income visitors to the park.

Social Values. Most winter visitors surveyed support mechanized access to the parks. In the context of overall access to the park, the changes proposed in alternative G are likely to result in major adverse impacts by eliminating some of the most heavily used winter motorized routes within the parks. Conversely, a portion of winter users favor reductions

in motorized use within the park. For this group, the alternative G travel restrictions would have a positive impact.

Current winter visitors to YNP are attracted by the current set of recreation opportunities, which include snowmobiling. These visitors support current management. Among summer visitors (as detailed in Chapter III), there is less support for current management. Among the general public, local residents are evenly divided between support for current management versus alternative G. However, this probably varies by county. For example, the Teton County, Wyoming survey (discussed in Chapter III) found a much higher overall local participation in cross-country skiing (mostly in GTNP) than snowmobiling. A majority of local residents feel that snowmobiles negatively impact Yellowstone in the winter and that snowmobiles should be limited in YNP in winter. Among the regional and national populations, many respondents favor the snowcoach option over the existing policy. For this group, alternative G would have a positive impact.

The potential for a successful shift in the type of winter recreation activity in this alternative indicated by participation rates. For example, nationally, regionally, and locally, cross-country skiing is just as, or slightly more, popular than snowmobiling. A decrease in opportunities for snowmobiles in YNP may shift participation rates to other winter activities such as cross-country skiing. A shift would be assisted by increased awareness and education programs alerting a national population about changing opportunities (via state tourism programs, business marketing, and NPS visitor information services).

Nonmarket Values. Alternative G potentially would impact nonmarket values of winter visitors through a reduction in current winter user visitation resulting from the restriction of mechanized travel to clean, quiet snowcoaches.

Based on the winter visitor survey, the nonmarket value of a trip to GYA parks is $91. It is estimated that park visitation would be reduced by 33.4% resulting from the management change. Based on current winter visitation levels, a 33.4% reduction in visitation would translate into a $2.7 million reduction in the aggregate nonmarket value of winter trips to the parks. This is a moderate negative impact. These estimates are based on reduced use by current visitors.

Conclusion

Alternative G management actions would have a negligible to minor negative impact on the five-county economy and a negligible negative to positive effect on the three-state economy through changes in visitation and nonresident visitor expenditures. Given the historical lack of correlation between year-to-year changes in winter visitation to YNP and the West Yellowstone economy, the reduced visitor expenditures under this alternative could have a moderate to negligible short-term adverse impact on the winter economy of West Yellowstone, Montana. The impact on the year-round West

Yellowstone economy is, at worst, a moderate short-term negative impact. Alternative G also would have a minor negative impact on total current trip nonmarket visitor benefits (through reduced visitation). The changes proposed in alternative G are likely to result in moderate adverse impacts to some visitors' social values and a moderate positive impact on other users' social values. This alternative could have an unspecified adverse impact on low-income visitor access to the park.

Summary of Estimated Visitation Changes from Alternative Winter Management Options. Eight specific impact estimates were calculated for the Final Environmental Impact Statement (FEIS) corresponding to estimates for two analysis areas for each of four alternative management options. Table 134 details the changes in total economic output and employment associated with each of the estimates. In all four winter management options, the estimated output and employment impact for the two analysis areas are less than 0.5% baseline levels.

Table 134. Estimated economic output and employment impacts of alternative winter management options.

Management Change	Analysis Area	Change in Output (Million 1997 Dollars)	% Change in Output	Change in Employment	% Change in Employment
Alternative B — Plow road from West Yellowstone To Old Faithful	5-county	-13.2	-0.23%	-312	-0.32%
	3-state	-14.4	-0.01%	-351	-0.02%
Alternative G — Snowcoach, skiing, snowshoe access only[†]	5-county	-14.4 to –19.2	-0.34%	-340 to –454	-0.47%
	3-state	-17.7 to +7.0	-0.02%	-430 to +170	-0.03%
Alternative F — Westside closure to all vehicles in winter	5-county	-14.4	-0.25%	-340	-0.35%
	3-state	-13.7	-0.01%	-334	-0.02%
Alternative D — Stop plowing from Colter to South Entrance	5-county	-1.3	-0.02%	-32	-0.03%
	3-state	+0.2	0%	+4	0%

[†] Increased winter visitation from current summer visitors to the park under this management option could substantially offset the estimated output and employment reductions from current winter visitors. This would depend in part on marketing and education programs implemented through the Winter Use Plan in cooperation with states and gateway communities.

An analysis of the regional economic and nonmarket impacts of alternative G, prepared by the State of Wyoming, is as follows:

> "The Draft Winter Use Plan/Environmental Impact Statement for the Yellowstone and Grand Teton National Parks and John D. Rockefeller, Jr. Memorial Parkway states that:
>
> 'The direct, indirect and induced expenditures generated in the GYA by nonresidents visiting the parks in the winter months are estimated to be about $63 million.'
>
> Table 19 of the DEIS indicates that 61% of the winter visitors to YNP snowmobile. Table 28 indicates that 97% of the winter visitors to GTNP snowmobile. A weighted average of winter visitors to the two parks indicates that 67% of the combined YNP and GTNP winter visitors snowmobile. Based on the methodology in the Draft EIS it might be assumed that 67% of the $63 million of economic impact from winter visitors in the parks is associated with snowmobiling.
>
> However, previous research in YNP indicates that snowmobilers tend to spend more than other winter visitors. For example, Littlejohn (1996) indicates that snowmobilers in YNP spend almost twice as much as cross-country skiers ($224 vs. $116). If this pattern holds for other winter visitors it would mean that while snowmobilers represent 67% of winter visitors, they represent 80% of the total economic impact of winter visitors in the GYA or $48 million ($60 million x 0.80). This could be the potential loss to the GYA under alternative G from banning snowmobiles.
>
> Based on information for alternative G of the Draft EIS, it is estimated that the total nonmarket value of winter trips to the GYA parks was about $29 million. Again based on the methodology used in the Draft EIS, it might be assumed that 67% of the $29 million in nonmarket value of winter trips to GYA parks is associated with snowmobiling. However, previous research indicates that snowmobilers value their trips more than other winter visitors. For example, the value of snowmobiling of participants was 2.8 times that for cross-country skiing, sightseeing, or general recreation. If this pattern holds for winter visitors to GYA parks it would mean that while snowmobilers represent 67% of the winter visitors represent 85% of nonmarket value of winter trips to GYA parks or $24.65 million ($29 million x 0.85). This could be the potential loss to the GYA under alternative G from banning snowmobiles."

This analysis by the State of Wyoming is based on several assumptions about snowmobiler behavior that are not supported by the results of the 1999 GYA winter visitor study. Specifically it assumes that (1) all snowmobile use in the parks will be lost to the GYA; (2) that other types of users (snowcoach, skiers) will not increase use; and (3) that all park day entries actually count as multi-day trips (equivalent to assuming zero re-entry). Other things being equal, these assumptions may lead to overstating impacts by a factor of three to four.

Effects on Air Quality and Public Health

Alternative G emphasizes clean, quiet oversnow access to the parks by restricting travel only to oversnow mass transit vehicles that can meet strict emissions and sound requirements. For example, an estimated 80 to 90 snowcoaches per day would operate on the West Entrance to Old Faithful Road, replacing the current January-February average of 550 snowmobiles per day. Table 135, Table 136, and Table 137 summarize the results of CO modeling for six locations in the three parks for alternative G. Table 135 and

Table 136 show the predicted maximum 1-hour average CO concentrations and the calculated maximum 8-hour average CO concentrations, respectively. The percent contribution of each vehicle type to the maximum CO concentrations also is provided in Table 137 for the six locations. Table 138 and Table 139 provide corresponding model results for PM_{10} for the same locations and conditions as those for CO.

Table 135. Maximum 1-hour average CO concentrations for alternative G.

Location	1-hr Maximum Concentration (w/o Background) (ppm)	1-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	1.50	4.50	94.9
West Entrance to Madison Roadway	0.50	3.50	95.8
Old Faithful Staging Area	1.20	4.20	7.1
Flagg Ranch Staging Area	1.63	4.63	5.3
Flagg Ranch to Colter Bay Roadway	0.20	3.20	81.8
Mammoth to NE Entrance Roadway	0.30	3.30	0

Table 136. Maximum 8-hour average CO concentrations for alternative G.

Location	8-hr Maximum Concentration (w/o Background) (ppm)	8-hr Maximum Concentration (w/ Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	0.71†	2.12†	94.9
West Entrance to Madison Roadway	0.24†	1.65†	95.8
Old Faithful Staging Area	0.20	1.60	7.1
Flagg Ranch Staging Area	0.27	1.68	5.3
Flagg Ranch to Colter Bay Roadway	0.09†	1.51†	81.8
Mammoth to NE Entrance Roadway	0.14†	1.55†	0

†Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{\wedge}0.365$ (Cooper and Alley 1990).

Table 137. Vehicle contribution to CO concentrations for alternative G.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	0	98.6	0	0	1.4	0	0
West Entrance to Madison Roadway	0	99.1	0	0	0.9	0	0
Old Faithful Staging Area	0	99.5	0	0	0.5	0	0
Flagg Ranch Staging Area	0	98.9	0	0	1.1	0	0
Flagg Ranch to Colter Bay Roadway	0	99.1	0	0	0.9	0	0
Mammoth to NE Entrance Roadway	0	0	26.5	66.9	0.5	0	6.1

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Table 138. Maximum 24-hour average PM_{10} concentrations for alternative G.

Location	24-hr Maximum Concentration (w/o Background) (ppm)	24-hr Maximum Concentration (w/Background) (ppm)	Change Relative to Alternative A (w/o Background) (%)
West Yellowstone Entrance	0.32†	23.32	99.3
West Entrance to Madison Roadway	0.32†	23.32	97.1
Old Faithful Staging Area	0.01	5.01	98.3
Flagg Ranch Staging Area	0.03	5.03	94.9
Flagg Ranch to Colter Bay Roadway	0†	5.00	100.0
Mammoth to NE Entrance Roadway	0.32†	5.32	0

†Estimated from the modeled maximum 1-hour average concentration based on the persistence formula $C_{t2} = C_{t1}*(t1/t2)^{0.365}$ (Cooper and Alley 1990).

Table 139. Vehicle contribution to PM_{10} concentrations for alternative G.

Location	Contribution (%)						
	SM	SC	AM	LT	HT	TB	SV
West Yellowstone Entrance	0	28.9	0	0	71.1	0	0
West Entrance to Madison Roadway	0	50.1	0	0	49.9	0	0
Old Faithful Staging Area	0	1.6	0	0	98.4	0	0
Flagg Ranch Staging Area	0	0.7	0	0	99.3	0	0
Flagg Ranch to Colter Bay Roadway	0	50.1	0	0	49.9	0	0
Mammoth to NE Entrance Roadway	0	0	22.5	46.6	26.7	0	4.2

SM = snowmobile, SC = snowcoach, AM = automobile, LT = light truck, HT = heavy truck, TB = tour bus, SV = shuttle van.

Visibility

The visibility assessment indicates that under alternative G, vehicle emissions would not cause any perceptible visibility impairment in the vicinity of the West Entrance, along the roadways, or in the vicinity of Old Faithful and Flagg Ranch.

Conclusion

As noted in Table 135, Table 136, and Table 138, the model predicts major beneficial impacts on CO and PM_{10} levels, relative to alternative A at the West Entrance and along the West Entrance to Madison road. The Old Faithful and Flagg Ranch staging areas would see a minor beneficial impact on CO levels and a major beneficial impact on PM_{10} levels. Major beneficial impacts from reduced CO and PM_{10} concentrations are predicted along the Flagg Ranch to Colter Bay roadway. These decreased concentrations would result from elimination of snowmobiles.

Effects on Public Safety

Late night oversnow travel would be prohibited from 11:00 P.M. to 5:00 A.M. in all three parks. This action would eliminate any potential for nighttime collisions between

snowmachines and wildlife. The effect of this action would be negligible since less than 1% of recorded accidents during the last three years have occurred in this time period. The primary benefit to public safety would be that all potential for snowmobile accidents, as well as snowmobile snowcoach conflicts, would be removed. Also, because snowcoach drivers generally have more familiarity with the road and its wildlife patterns than the casual visitor, the elimination of private vehicles on this road would reduce the overall potential for motor vehicle accidents (snowcoaches are involved in less than 3% of accidents). In addition this alternative eliminates the potential for inter-modal conflicts between different types of snowmachines and facilitates nightly grooming, which is also a benefit to safety.

In GTNP closing the road between Colter Bay and Flagg Ranch to wheeled-vehicles would eliminate the potential for inter-modal conflict along this stretch of the CDST. It would eliminate a major source of winter vehicle accidents, vehicle-wildlife accidents and unsafe vehicular activity. Elimination of both snowmobiles and snowplanes from the surface of Jackson Lake would also eliminate the potential for user conflicts and accidents involving poor ice on the lake's frozen surface.

Conclusion

The benefits of implementing this alternative would be long term, major and beneficial due to the elimination of all potential snowmobile accidents in the three parks. These impacts would affect employees and visitors.

Effects on Geothermal Features

Under this alternative, roads would be groomed and access would be allowed only with mass transit vehicles. Using mass transit would allow park management some control over what stops along the roadway, thus increasing protection for geothermal features in areas where there are adverse levels of impact. The increase in opportunities to inform visitors of adverse impacts on geothermal resources would provide minor beneficial improvements to the protection of geothermal features.

The impacts of unrestricted backcountry use and the grooming of nonmotorized trails in Mammoth Terraces, Lone Star Geyser Basin, and Fountain Flats would be the same as those described under alternatives A and C.

Conclusion

Under this alternative the protection of geothermal features would be improved, although minor adverse impacts may occur to Fountain Flats and backcountry geothermal features.

Effects on Water and Aquatic Resources

Potential pollution sources are the same as described in alternative A. The potential impacts along all road segments would decrease with the prohibition of snowmobiles.

Table 140. Snowmachines and associated risk levels for alternative G.

Road Segment	Risk ± Rating‡	Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. A†		Impact: Daily Vehicle Miles Traveled Along the Segment in Alt. G†	
		SM‡	SC	SM	SC
Mammoth to Norris	Medium	641	69	0	168
West Entrance to Madison	Medium	7759	127	0	1232
Madison to Norris	High	3458	73	0	560
Norris to Canyon Village	Low	2214	47	0	360
Canyon Village to Fishing Bridge	High	2370	50	0	384
Fishing Bridge to East Entrance	Medium	983	0	0	135
Fishing Bridge to West Thumb	Medium	2627	55	0	420
Madison to Old Faithful	High	7818	165	0	1280
Old Faithful to West Thumb	Medium	3560	73	0	578
West Thumb to Flagg Ranch	Medium	4219	103	0	696
Grassy Lake Road	High	184	0	0	32
Flagg Ranch to Colter Bay	Low	379	0	0	464
Colter Bay to Moran Junction	High	248	0	0	0
Moran Junction to East Entrance	Medium	49	0	0	0
Teton Park Road	Low	156	0	0	0
Moose-Wilson Road	Low	6	0	0	0

†SM = Snowmobile, SC = Snowcoach; The source of pollutants is emissions from snowmobiles, which produce (conservatively) 10 times as many emissions per mile as most wheeled vehicles. Single snowcoaches produce fewer emissions than single snowmobiles.
‡±High = within 100 meters of aquatic system on 76% to 100% of the road segment; Medium = within 100 meters on 51% to 75% of the road segment; Low risk segments are within 100 meters of rivers less than 50%.

Conclusion

Deposition into snowpack from 2-stroke engine emissions along groomed park roads in YNP and GTNP would be eliminated. Emissions from snowcoaches, with improvements phased in, would continue to be deposited in snowpacks, at lower volumes over time. The effect of this deposition on water quality is undetermined but there is currently no evidence of measurable changes in water quality or effects on aquatic resources. It is possible that accumulations of pollutants in aquatic systems may have adverse impacts on wetlands and aquatic resources downstream from high risk road segments. Oversnow vehicle use in this alternative involves localized high risk to surface water quality, but reduces oversnow vehicle-miles traveled along high risk road segments in the three park units by about 84%. It would reduce oversnow vehicle-miles traveled along medium risk road segments by about 84%. The risk of moderate to major adverse impacts on water quality in Jackson Lake would be eliminated.

Mitigation

Best management practices would be utilized during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation. The release of snowpack contaminants into surface water could be

mitigated by disconnecting snowmelt drainages from trails by oversnow vehicles. Any new or reconstructed winter use sanitary facilities would be constructed in locations and use advanced technologies that would protect water resources. A focused program of monitoring would reduce the uncertainty of impacts from oversnow vehicles and, if necessary, indicate best management practices that might be implemented.

Effects on Wildlife

Ungulates

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative G, YNP would groom an additional 4 miles (of previously designated route) over alternative A for a total of 225 miles, and GTNP and the parkway would groom about 24 miles (12 miles less than alternative A due to the elimination of the CDST).

The impacts associated with groomed surfaces would decrease relative to alternative A for GTNP, and remain the same for YNP. Under this alternative, adaptive management could be employed to revise management of groomed roads should monitoring and research clearly indicate adverse effects to bison and other ungulates.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause injury and death for wildlife, especially in poor lighting conditions and during snowfall, and can cause displacement from preferred habitats.

This alternative reduces the potential effects on ungulates by eliminating snowmobile use. A minor risk of collision and short-term stress-induced movement would continue with the use of snowcoaches. However, compared to current levels of snowmobile use, traffic levels would be reduced by a factor of eight, and no ungulates have been struck by snowcoaches (Gunther et al. 1998). Furthermore, NPS policy would require that snowcoach drivers be trained and that stops be made only in areas where wildlife would be unaffected. The elimination of the CDST would benefit moose because this route intersects moose winter range in the northern part of GTNP. In all parks, collisions would be mitigated by the prohibition on oversnow motorized use from 11 P.M. to 5 A.M.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to ungulate movements (Aune 1981). In addition plowed roads, like groomed roads, also may provide an energy efficient mechanism for wildlife movements, including bison, elk, and moose. Under alternative G, YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as under current management. GTNP would plow 82 miles, a reduction of 17 miles as a result of replacing wheeled-vehicles with snowcoaches from Colter Bay north to Flagg Ranch.

For YNP, the effects associated with plowed roads would be the same as alternative A. Effects associated with plowed roads in GTNP would be the same as those described in alternative D. Relative to current management, impacts would be reduced and negligible, especially for moose north of Colter Bay in GTNP.

Effects of motorized use of plowed roads. The effects of plowed roads are similar to those of groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death for wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

For YNP, the effects associated with plowed roads would be the same as alternative A. Effects associated with plowed roads in GTNP would be the same as those described in alternative D. Relative to current management, impacts would be reduced and negligible, especially for moose north of Colter Bay in GTNP.

Effects of nonmotorized use of groomed and designated ungroomed routes. The primary effects of nonmotorized use on ungulates are displacement from preferred habitats, especially geothermal areas that are important for winter survival in YNP, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. In alternative G, YNP offers 37 miles of groomed nonmotorized routes, the same as alternative A, and GTNP and the Parkway remain the same at 26 miles.

The level of impact in the parks would be the same as alternative A — minor.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and ungulates may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Under alternative G, nonmotorized uses in certain wildlife winter ranges and thermal areas would be restricted to travel on designated routes only.

Effects decrease relative to alternative A. In GTNP winter use in important bighorn sheep winter ranges would be restricted or prohibited, including areas in the north and south Teton Range.[43]

[43] Southern Tetons: (1) in the Prospectors Mt. and Mt. Hunt areas (including peak 10988), all areas above 3000m (9,900 ft.), and south-facing slopes on Mt. Hunt above 2600m (8,580 ft.); (2) the slopes of Static Peak above 3300m (10,890 ft.) (does not affect Albright Peak); and (3) the south-facing slopes above 3000m (9900 ft.) along the north side of Avalanche Canyon and the north fork of Avalanche Canyon.
Northern Tetons: 1) in the Ranger-Doane-Eagles Rest area (including peaks 10,298; 10,881; 10,023; 10,686), all areas above 3,000 m (9,900 ft.), and south-facing slopes of Eagles Rest above 2,600m (8,580 ft.); 2) in the Elk Mt.-Owl Peak area, all areas above 3,000 m (9,900 ft.), and south-facing slopes above 2,600m (8,580 ft.); 3) on Forellen Peak, all areas above 2,800 m (9,240 ft.)

Effects of the presence and use of winter support facilities. Increases in human activity associated with the presence of support facilities may displace species sensitive to human disturbance. Under this alternative, a warming hut would be constructed at Norris in the vicinity of ungulate winter range important to elk, deer, and bison. Introducing winter human use into this area would reduce its habitat effectiveness by potentially causing these species to be displaced to lower quality habitats. However, over time, the predictable nature of the recreation expected to occur in the area may allow these species to habituate to the increase in human activity. Effects could be the same as in alternative A, minor and short term.

Federally Protected Species

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative G, YNP would groom an additional 4 miles (of previously designated route) over alternative A for a total of 225 miles, and GTNP and the Parkway would groom about 24 miles (12 miles less than alternative A due to the elimination of the CDST).

Impacts related to packed trails would be less relative to alternative A in GTNP and remain the same in YNP. The extent to which packed surfaces influence lynx in the parks are largely unknown but would be investigated (see mitigation).

Effects of motorized use of groomed and ungroomed roads and trails. The use of motorized oversnow vehicles can cause displacement from preferred habitats. Collision impacts from oversnow motorized vehicles have not been documented for any of the federally protected species in the parks.

Impacts are generally decreased relative to alternative A. The elimination of snowmobiles from the three parks would decrease impacts related to noise and displacement. Use of snowcoaches would continue to potentially displace lynx because these routes pass through areas of lynx habitat, but the effects of snowcoaches would be less than those associated with snowmobiles because snowmobiles would be fewer in number and slower. Because the majority of visitors would be traveling on NPS-managed snowcoaches, the ability to control where and when stops are made would benefit all species. If federally protected species activity is detected, park managers can close the area to human activity to mitigate disturbance.

Effects of plowed roads. Road plowing may cause habitat fragmentation by creating structural barriers (i.e., snow berms) to wildlife movements (Aune 1981). In addition similar to groomed roads, plowed roads may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to

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and south-facing slopes above 2,500 m (8,250 ft.); and 4) the ridgecrest and south-facing slopes of the cliffs at the mouth of Moose Creek (also known as the “Lower Berry Cliffs”) above 2,300 m (7,590 ft.).

deep snow. Under alternative G, YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as under current management. GTNP would plow 83 miles, a reduction of 17 miles as a result of replacing wheeled vehicles with snowcoaches from Colter Bay north to Flagg Ranch.

Impacts are generally as stated in alternative A for YNP and would decrease in GTNP. If protected species are detected in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of motorized use of plowed roads. The effects of traffic on plowed roads are similar to those of traffic on groomed roads, except that the magnitude of the effect is usually greater. The use of motorized vehicles on plowed roads can cause injury and death to wildlife, especially in poor lighting conditions, at dusk and dawn, and during snowfall, and can cause displacement from preferred habitats.

Impacts are generally as stated in alternative A — none to minor. Collision impacts to wolves and lynx may be reduced by the elimination of wheeled vehicles on the road from Colter Bay to Flagg Ranch.

Effects of nonmotorized use on groomed and designated ungroomed routes. The primary effects of nonmotorized use on wildlife are displacement from preferred habitats and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. In alternative G, YNP offers 37 miles of groomed nonmotorized routes, the same as alternative A, and GTNP and the Parkway would remain the same at 26 miles.

Impacts are generally as stated in alternative A — none to negligible.

Effects of unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and federally protected wildlife species may only occur sporadically, they may cause displacement and additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Under alternative G, nonmotorized uses in certain wildlife winter ranges and thermal areas are restricted to travel on designated routes only, or closed to use entirely.

The potential for bear-human confrontation or conflicts due to the earlier opening of the winter use season (Thanksgiving weekend) would be limited to nonmotorized users who leave the road corridor and travel into high-elevation areas frequented by bears prior to denning. The likelihood of visitors coming into contact with grizzly bears during this time would be small. Although some bears (about 10%) may still be active in late November, park visitation at this time is expected to be low due to generally poor snow conditions, thus the earlier opening date would not be expected to result in a substantial increase in early winter visitation. Furthermore, based on visitation records for the past

seven years, an average of 12,485 people visited the parks in December to participate in oversnow-related activities. Calculated on a per day basis for the period of time from November 27 to December 15 (the initiation of the winter use season that coincides with the time when some bears may still be active), about 8,442 visitors. Skiers comprise about 20% of this figure (1,688). Of this 20%, half (844) indicated that they ski for less than four hours (Littlejohn 1996). Thus, it can be inferred that these skiers were not backcountry users, but remained on the groomed roads or trails in the front country, consequently, the odds of their encountering grizzly bears are small. Other surveys estimated the percentage of visitors who come to the park to ski as 10% (Borrie et al. 1999) and 24% (Duffield and Neher 1999). To minimize potential conflicts between visitors and bears during the pre-denning period, visitors in certain wildlife winter ranges would be restricted to designated trails, and according to park policy, other areas where pre-denning activity is high may close at the discretion of park managers.

Restrictions on use would reduce the level of effect relative to alternative A. Closures and restrictions may help to mitigate any increased potential for human-bear conflicts due to the earlier opening date of the winter use season (Thanksgiving weekend).

Presence and use of winter support facilities. Warming huts and campgrounds can cause habituation in some wildlife species by the presence of human food and garbage, and can lead to human-wildlife conflicts. In addition increased human activity associated with the presence of support facilities may displace species sensitive to human disturbance. A warming hut at Norris is the only new facility proposed under alternative G.

Potential impacts are generally as stated in alternative A — none to minor. All alternatives call for the construction of wildlife-proof garbage facilities to mitigate the potential effect of habituating animals, particularly bears.

Species of Special Concern

Effects of groomed roads and trails. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow; inhibit foraging activities of carnivores that tunnel beneath the snow to hunt subnivian prey; and reduce subnivian prey availability by increasing mortality of these small mammals. Under alternative G, YNP would groom an additional 4 miles over alternative A (of previously designated route) for a total of 225 miles, and GTNP and the Parkway would groom 24 miles (12 miles less than alternative A due to the elimination of the CDST).

For all species, known impacts related to packed trails are generally as stated in alternative A — none to negligible. In GTNP the reduction in packed surface area relative to alternative A would potentially benefit the ability of martens to tunnel and forage under the snow.

Effects of motorized oversnow use of groomed and ungroomed roads and trails. The most likely impacts to park sensitive species are displacement from preferred habitats, and degradation of the aquatic environment from pollutants in the snowpack. Documented mortality caused by collisions with oversnow vehicles in the parks is rare — in 10 years only one of these species (a marten) was reportedly killed by a snowmobile in YNP (Gunther et al. 1998).

Impacts are generally as stated in alternative A — none to minor. The elimination of snowmobiles from the parks would decrease impacts related to noise and displacement. Use of motorized oversnow vehicles would continue to potentially displace fishers, martens, and, in YNP, swans. Because the majority of visitors would be traveling in snowcoaches, the ability to control where and when stops are made would potentially benefit all species. In addition effects associated with motorized use would decrease because snowcoaches would be fewer in number, slower, and quieter.

See *Water and Aquatic Resources* for an assessment of the impacts of exhaust on water quality in the parks.

Effects of plowed roads. Similar to groomed roads, plowed roads also provide an energy efficient mechanism for wildlife movements. Under alternative G, YNP would plow 76 miles of road for wheeled-vehicle access in the winter, the same as under current management. GTNP would plow 82 miles, a reduction of 17 miles as a result of replacing wheeled vehicles with snowcoaches from Colter Bay north to Flagg Ranch.

Impacts are generally as stated in alternative A for YNP and less for GTNP. If protected species are detected in an area, park managers can close the area to human activity to mitigate disturbance.

Effects of motorized use of plowed roads. The most likely impact to park species of special concern is displacement from preferred habitats and mortality caused by collisions with wheeled-vehicles.

Impacts are generally as stated in alternative A — none to negligible. The elimination of 16 miles of plowed road from Colter Bay to Flagg Ranch would potentially decrease effects related to displacement.

Effects of nonmotorized use on groomed and ungroomed designated routes. The primary effects of nonmotorized use are displacement from preferred habitats, and increased energy expenditures, including physiological stress, which may reduce individuals' chances of survival. In alternative G, YNP offers 37 miles of groomed nonmotorized routes, the same as alternative A, and GTNP and the Parkway remain the same at 26 miles.

Impacts are generally as stated in alternative A — none to minor.

Unregulated backcountry nonmotorized use. Unregulated backcountry nonmotorized use is more random and infrequent relative to nonmotorized use on designated routes. Consequently, although encounters between backcountry users and species of special management concern may only occur sporadically, they can be especially disturbing and lead to additional energy expenditure and stress that reduces animals' chances of survival and reproduction. Under alternative G, nonmotorized uses in certain wildlife winter ranges and thermal areas are restricted to travel on designated routes only, or closed entirely.

Effects associated with backcountry use would be reduced relative to alternative A. Impacts, if they did occur, would be negligible to minor. Wolverines and other species that consume carrion may benefit by restrictions and closures in wildlife winter ranges, and there may be a decrease in disturbance to sagebrush lizard habitats.

Presence and use of winter support facilities. The primary effects of warming huts and campgrounds on park species of special concern are associated with increases in human activity and the subsequent disturbance and displacement of species or their prey. A warming hut at Norris is the only new facility proposed under alternative G.

Potential impacts are generally as stated in alternative A — none to minor.

Conclusion

The potential levels of impacts associated with alternative G are similar to those under alternative A – none to minor, adverse, and short term. There would be an expected reduction or elimination of road-killed large mammals due to the elimination of snowmobiles in all parks and the reduction in wheeled-vehicle traffic in GTNP. In addition the replacement of individual snowmobiles with mass transit snowcoaches will serve to decrease effects associated with displacement, including the sound, speed, and volume of traffic. Closures or restrictions in backcountry areas also significantly differentiate this alternative from current management, and may benefit winter-stressed ungulates and other wildlife. Adaptive management may be employed to make adjustments in management if and when impacts to wildlife are determined.

Although impacts to populations resulting from winter recreation are neither long-term nor very significant, impacts to individual members of the population can be important, leading to death either directly from collisions or continued harassment, or indirectly through management actions taken as a response to habituation to human presence and food. The NPS is concerned about impacts to individual animals; however, except for federally protected species, which are protected, the NPS provides for the protection of populations of native animals. See, for example, Chapter II, NPS 77, Natural Resources Management.

Ungulates

- Effects of groomed roads and trails on animal movements – unknown if and to what extent beneficial effects outweigh negative effects. Effect is reduced relative to alternative A in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on: 1) mortality caused by collisions – adverse, none to negligible, and short term; and 2) displacement from preferred habitats – adverse, negligible to minor, and short term. Greatly reduces collision impacts over alternative A due to the elimination of snowmobiles.
- Effects of plowed roads on: 1) habitat fragmentation – adverse, minor, and short term; and 2) animal movements – unknown if and to what extent beneficial effects outweigh negative effects (same as alternative A for YNP). In GTNP effects would decrease as compared to alternative A.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, minor, and short term; and 2) displacement from preferred habitats – adverse, moderate, and long term (same as alternative A for YNP). In GTNP effects would decrease as compared to alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, minor, and short term. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible to minor, and short term. Effects decrease relative to alternative A due to restrictions on backcountry travel. Impacts to bighorn sheep in GTNP would significantly decrease.
- Effects of the presence and use of winter support facilities on displacement – adverse, minor, and short term. Same as alternative A.

Federally Protected Species

- Effects of groomed roads and trails on animal movements: 1) bald eagles, grizzly bears, and wolves — no effect; and 2) lynx – adverse, negligible to major, and short term, depending upon lynx distribution and abundance in the parks. Effect is decreased relative to alternative A in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement from preferred habitats – adverse, negligible, and short term for all species excluding the grizzly bear, which typically is not active during the winter use season. Effect is decreased relative to alternative A due to the elimination of snowmobiles.
- Effects of plowed roads on: 1) habitat fragmentation – no effect on any of the listed species; and 2) animal movements – no known effect on any of the listed species. Same as alternative A for YNP and less than alternative A for GTNP.
- Effects of motorized use of plowed roads on: 1) mortality caused by collisions – adverse, negligible, and short term on bald eagles and grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx; and 2) displacement from preferred habitats – adverse, negligible, and short term on bald eagles, no effect on grizzly bears; no known effect to date on wolves and lynx. May decrease impacts to wolves and lynx relative to alternative A due to the elimination of wheeled vehicles from Colter Bay to Flagg Ranch. Otherwise, effects are generally the same as alternative A.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – adverse, negligible, and short term on bald eagles; no effect on grizzly bears; no known effect to date on wolves and lynx. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, minor, and short term on bald eagles; adverse, negligible, and short term on grizzly bears; adverse, minor, and short term on wolves; no known effect to date on lynx. Effects decrease relative to alternative A due to restrictions on backcountry travel in both parks. Restrictions may also mitigate any potential grizzly bear-human conflicts associated with the early opening date of the parks.

- Effects of the presence and use of winter support facilities on displacement – no affect on bald eagles; adverse, negligible, and short term on grizzly bears, with mitigation; adverse, minor, and short term on wolves; no effects on lynx. Effects are the same as alternative A.

Species of Special Concern

- Effects of groomed roads and trails on 1) animal movements – no known effect on wolverines; adverse, negligible, and short term on fishers and martens; no effect on otters, swans, reptiles, amphibians, and fish; 2) foraging activities – adverse, negligible, and short term on marten; no effect on the other species; and 3) subnivian prey availability — adverse, negligible, and short term on marten; no effect on the other species. Effects are reduced relative to alternative A in GTNP.
- Effects of motorized oversnow use of groomed and ungroomed roads and trails on displacement – no known effect on wolverine; adverse, negligible, and short term on fishers and marten; no effect on otters, reptiles, amphibians, and fish; adverse, minor, and short term on swans. Effect is decreased relative to alternative A due to the elimination of snowmobiles.
- Effects of plowed roads on animal movements – no known effect on wolverines, fishers, martens; no effect on otters, swans, reptiles, amphibians, fish. Same as alternative A.
- Effects of motorized use of plowed roads on displacement from preferred habitats: 1) adverse, negligible, and short term on wolverines, fishers, and martens; no effect on otters, swans, reptiles, amphibians, and fish; and 2) mortality from collisions — adverse, negligible, and short term on otters and martens; no effect to date on other species. Same as alternative A. Impacts may be decreased relative to alternative A due to the elimination of wheeled—vehicles from Colter Bay to Flagg Ranch.
- Effects of nonmotorized use of groomed and designated ungroomed routes on displacement from preferred habitats – no effect on wolverines; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; adverse, negligible, and short term on sagebrush lizard no effect on rubber boa, amphibians, and fish. Same as alternative A.
- Effects of unregulated backcountry nonmotorized use on displacement from preferred habitats – adverse, negligible, short term on wolverines and sagebrush lizard; no known effect on fishers, martens, and otters; adverse, minor, and short term on swans; no effect on rubber boa, amphibians, and fish. Effects decrease relative to alternative A due to restrictions on backcountry travel in all parks. Wolverines may benefit from bighorn sheep closures in GTNP.
- Effects of the presence and use of winter support facilities on displacement of potential prey (carcass) availability – adverse, minor, short term on wolverines, fishers, and martens; no effect on swans, rubber boa, amphibians, and fish; no known effect on otters; adverse, minor, and short term on sagebrush lizard. Same as alternative A.

Mitigation

- Grizzly bear abundance, distribution and habitat selection, including the location of dens would continue to be assessed. The information obtained will assist park managers in protecting important habitats and planning recreational activities that minimize disturbance to bears.
- Snow track surveys for carnivores, including lynx, on both groomed and ungroomed routes would be conducted.
- Use of groomed, ungroomed, and plowed surfaces by bison and other ungulates would continue to be monitored.

Effects on Natural Soundscape

Audibility analysis — combined effects of all wheeled and oversnow vehicles

Table 141 presents the acres of park land by road segment where any wheeled or oversnow vehicle noise would be audible under the two background conditions, "average" and "quiet," as defined in the *Assumptions and Methodologies* section of this chapter. For each background condition, acreage is presented for three categories of audibility: (1) audible for any amount of time (labeled "audible at all"); (2) audible for 10% of the time or more; and (3) audible for 50% of the time or more. Appendix M contains tables with distances to audibility for each segment for each alternative.

Alternative G features no motorized vehicles of any type on Jackson Lake and Teton Park Road in GTNP. It also replaces snowmobiles with snowcoaches in YNP, and replaces snowmobiles and wheeled vehicles with snowcoaches from Colter Bay to Flagg Ranch and on the Grassy Lake Road.

The results for alternative G show that for the "average" background sound level condition, wheeled or oversnow vehicles would be audible to some degree on more than 178,000 acres in the three park units. On more than 74,000 of those acres, wheeled or oversnow vehicles would be audible for at least 10% of the time during the day. For nearly 13,000 of those acres, they would be audible for at least half of the time during the day. These acreage totals increase by 12% for the "audible at all" category, 27% for the "audible 10% or more" category, and 9% for the "audible for 50% of the time or more" category for the "quiet" background conditions.

The segment from Moran Junction to the South Entrance of GTNP, which carries a great deal of wheeled-vehicle traffic unrelated to the alternatives, contributes the greatest to the total acreage values for all three audibility categories. These amounts remain almost constant for all of the alternatives.

The plowed road from Mammoth to the YNP Northeast Entrance is a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more"), which remains virtually unchanged across all of the alternatives.

Compared to the no action alternative, there are increases in acreage for the "audible at all" categories for all of the YNP road segments using snowcoaches only due to the long distances to audibility for the Bombardier Snowcoaches as discussed under the *Effects Common to All Alternatives* section of this chapter. Likewise, there is nearly a doubling in acreage for the Flagg Ranch-Colter Bay segment. However, these increases are more than compensated for by the elimination of oversnow vehicles on Jackson Lake and Teton Park Road, leading to the overall reduction in acreage.

For the "audible for 10% of the time or more" categories, the acreage compared to the no action alternative increases for some YNP segments and decreases for others.

For the "audible for 50% of the time or more" categories, there are major reductions in acreage for the YNP West Entrance to Madison, Madison to Old Faithful, and West Thumb to Flagg Ranch segments, due to the reduction in total vehicular traffic, in addition to those segments where oversnow vehicles would be eliminated.

Table 141. Acres of park land affected by vehicle audibility for alternative G.

Road Segment	Miles	With Average Background Conditions			With Quiet Background Conditions		
		Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
1. Mammoth to Northeast Entrance	47	16,126	5,445	0	16,822	6,342	0
2. Mammoth to Norris	21	11,671	649	0	12,734	1,225	0
3. West Entrance to Madison	14	11,129	7,049	433	12,487	8,128	556
4. Madison to Norris	14	9,075	4,913	0	10,275	6,002	0
5. Norris to Canyon Village	12	5,740	1,031	0	6,637	2,518	0
6. Canyon Village to Fishing Bridge	16	10,883	4,433	0	12,233	5,521	0
7. Fishing Bridge to East Entrance	27	14,805	0	0	16,100	0	0
8. Fishing Bridge to West Thumb	21	17,671	10,032	0	20,423	12,495	0
9. Madison to Old Faithful	16	13,393	8,573	870	15,098	9,746	1,170
10. Old Faithful to West Thumb	17	10,207	4,822	0	11,549	5,918	0
11. West Thumb to Flagg Ranch	24	14,008	3,926	0	16,141	7,618	0
12. Grassy Lake Road	7.6	2,122	0	0	2,376	0	0
13. Flagg Ranch to Colter Bay	15.6	13,437	6,808	0	15,405	9,723	0
14. Colter Bay to Moran Junction	10.2	4,579	1,825	0	4,926	2,040	0
15. Moran Junction to East Entrance	2	1,225	753	490	1,319	863	535
16. Moran Junction to South Entrance	26	21,714	14,536	11,123	23,842	16,922	11,825
17. Teton Park Road	15	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	2.5	659	0	0	695	0	0
19. Antelope Flats Snowmobile Route	--	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
20. Jackson Lake	9.7	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.	No Veh.
TOTAL		178,445	74,795	12,916	199,063	95,060	14,087

Average sound level analysis

To give a sense of the effect of the number of oversnow or wheeled vehicles on a road segment, and their speed and sound level, Table 142 shows the computed hourly equivalent or "average" sound level (L_{eq}) over the daytime period. Levels are shown for each road segment at two distances, 100 feet and 4,000 feet, and for both open and forested terrain. These hourly L_{eq} values do not have the background sound level added in to them. Also, they cannot be compared against the background levels to assess audibility, because L_{eq} represents a long-term average of both quiet and loud moments.

The hourly L_{eq} at 100 feet are highest for the West Entrance to Madison and Madison to Old Faithful segments. The L_{eq} are reduced substantially (7 dB to 8 dB) compared to alternative A for the YNP road segments where the snowmobiles would be replaced with snowcoaches. At 4,000 feet away, the L_{eq} are also highest for the West Entrance to Madison and Madison to Old Faithful segments, as well as the segments from Moran Junction to both the East Entrance and the South Entrance of GTNP.

Table 142. Average hourly L_{eq} from wheeled and oversnow vehicle noise at two distances to each road segment for alternative G.

Road Segment	L_{eq} at distance (dBA)			
	Open Terrain		Forested Terrain	
	100 feet	4,000 feet	100 feet	4,000 feet
1. Mammoth to Northeast Entrance	35	2	33	0
2. Mammoth to Norris	42	6	40	0
3. West Entrance to Madison	49	15	47	7
4. Madison to Norris	46	12	44	4
5. Norris to Canyon Village	44	10	43	2
6. Canyon Village to Fishing Bridge	43	9	42	1
7. Fishing Bridge to East Entrance	36	2	35	0
8. Fishing Bridge to West Thumb	43	9	41	1
9. Madison to Old Faithful	49	15	47	7
10. Old Faithful to West Thumb	45	11	43	3
11. West Thumb to Flagg Ranch	44	10	42	2
12. Grassy Lake Road	42	2	41	0
13. Flagg Ranch to Colter Bay	44	10	42	2
14. Colter Bay to Moran Junction	40	7	38	0
15. Moran Junction to East Entrance	47	13	45	5
16. Moran Junction to South Entrance	46	14	44	6
17. Teton Park Road	No Veh.	No Veh.	No Veh.	No Veh.
18. Moose-Wilson Road	24	0	22	0
19. Antelope Flats Snowmobile Route	No Veh	No Veh	No Veh	No Veh.
20. Jackson Lake	No Veh	No Veh	No Veh	No Veh.

Conclusion

Alternative G impacts 97% to 98% of the acreage impacted by the no action alternative for the “audible at all” categories, the second highest after alternative C. Increases in acreage for the YNP and GTNP road segments using only snowcoaches are more than compensated for by the elimination of oversnow vehicles in all of GTNP except the Flagg Ranch to Colter Bay and Grassy Lake Road segments.

Alternative G impacts 79% and 89% of the no action acreage for the “audible 10% of the time or more” categories for the “average” and “quiet” background conditions,

respectively. These percentages are the third highest among the alternatives for the "average" background and highest for the "quiet" background.

For the "audible 50% or more" categories, alternative G impacts only 53% to 55% of the acreage for the no action alternative. These reductions are the greatest among the alternatives, and are due to the exclusive use of snowcoaches in YNP.

The contributions to the L_{eq} are reduced to zero for those road segments where vehicular travel of all types is eliminated, and are substantially reduced for those segments where snowcoaches replace snowmobiles.

Effects on Cultural Resources

The effects on cultural resources would be the same as described in alternative B.

Conclusion

None of the actions described would adversely impact cultural resources.

Effects on Visitor Access and Circulation

Access

Yellowstone National Park. Overall, access to park resources would not be affected by this alternative, although visitors would be required to change their mode of motorized travel to these resources from snowmobile to snowcoach.

Grand Teton National Park and the Parkway. Under this alternative, access to Flagg Ranch would be closed to wheeled vehicles and snowmobiles in the winter use season. Access to Flagg Ranch would be limited to snowcoach. Access to other areas of the park would remain, although some limited changes in mode of travel would occur.

A reasonably foreseeable distribution of vehicle use as a consequence of this alternative is depicted in the following table. Since the parks would be closed to snowmobiles there would be a 100% decrease in snowmobile vehicle-miles traveled in the three park units. Because snowcoaches would provide motorized access at current visitation levels to YNP's interior, from Colter Bay to Flagg Ranch and Flagg Ranch to the west boundary of the Parkway, there would be an increase of 723% in snowcoach-miles traveled. Daily wheeled-vehicle-miles traveled in this scenario would decrease by about 3%.

Table 143. Alternative G motorized use.

Road Segment	Average Daily Vehicle Use January-February				
	Autos	**Vans**	**Snowcoaches**	**Snowmobiles**	**Buses**
Mammoth to Northeast Entrance	No change from current condition				
Mammoth to Norris	0	0	8	0	0
West Entrance to Madison	0	0	88	0	0
Madison to Norris	0	0	40	0	0
Norris to Canyon Village	0	0	30	0	0
Canyon Village to Fishing Bridge	0	0	24	0	0
Fishing Bridge to East Entrance	0	0	5	0	0
Fishing Bridge to West Thumb	0	0	20	0	0
Madison to Old Faithful	0	0	80	0	0
Old Faithful to West Thumb	0	0	34	0	0
West Thumb to Flagg Ranch	0	0	29	0	0
Grassy Lake Road	0	0	4	0	0
Flagg Ranch to Colter Bay	0	0	29	0	0
Colter Bay to Moran Junction	190	10	0	0	1
Moran Junction to East Entrance	560	28	0	0	2
Moran Junction to South Entrance	No change from current condition				
Teton Park Road	0	0	0	0	0
Moose-Wilson Road	5	0	0	0	0
Antelope Flats Snowmobile Route	No change from current condition				

Concession Services

Present concessions affected in this alternative would be all those permitted to run snowmobile guided tours or provide snowmobile rentals (under concession contracts) for use in the parks. This would adversely affect permittees or concessioners and their employees at all gateways and destinations in the parks by removing the source of winter income associated with this activity.

Oversnow tour and transportation services from all affected locations would need to be developed or enhanced in order to meet visitor needs in this alternative. Approximately 180-200 snowcoaches would be necessary to accommodate today's use levels. This includes snowcoach access to and from the East Entrance of YNP once safer and more feasible coaches are available. Since the availability of access does not change, only the mode, concession operations would have the opportunity to adapt to the change while still providing visitor services to and in the parks.

At Old Faithful, the logistics of moving people, fuel, supplies, or garbage would remain dependent on oversnow transport. Storage of material in the park's interior would be the same as at present.

Concessions and services offered at Flagg Ranch in the Parkway, would be affected by not plowing the highway north of Colter Bay, and by eliminating snowmobile access from Idaho via the Grassy Lake Road. NPS-managed snowcoach access from Idaho would be allowed. The segment connecting Colter Bay and Flagg Ranch would be accessible via NPS managed (concession) snowcoach only. Instead of wheeled-vehicle access, most employees and clients would travel to and from the ranch by snowcoach. Flagg Ranch would be snowbound, offering a more specialized experience than at present – similar to Old Faithful. Its business focus would need to support and capitalize on nonmotorized winter recreation, as would Old Faithful. This change would entail operational changes and higher expenses for the concessioner in terms of moving supplies and employees, and providing winter storage space.

The time available under this alternative for business adaptation is three years, when all snowmobile access would be terminated in the winter 2003-2004.

The implementation of any alternative that might make substantial changes affecting a concessioner would require negotiation between the NPS and the concessioner or be deferred until a new concessions contract is awarded.

Conclusion

Negligible impacts to park access in all three parks would occur because access is not altered, only the mode of travel is changed. Minor adverse impacts would occur in GTNP because all motorized use on Jackson Lake is eliminated.

Effects on Visitor Experience — Yellowstone National Park

The amount and type of visitor opportunities offered in YNP under alternative G are provided in Table 144.

Table 144. YNP Visitor opportunities available under alternative G.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	0	-184	Mid-December to Mid-March	Late night closure
Groomed motorized route, snowcoach only	184	0	Mid-December to Mid-March	Late night closure
Groomed motorized trail	0	0	Mid-December to Mid-March	Late night closure
Plowed route	76	0	Mid-December to Mid-March	Late night closure
Groomed nonmotorized	37	0	Mid-December to Mid-March	Late night closure
Warming huts	7	+1	Mid-December to Mid-March	Late night closure
Backcountry	2.2 million acres	0	Contingent on snowfall in northern portion of park	None

Visitor Satisfaction and Experience

Opportunities to view wildlife. Opportunities to view wildlife would not decrease under this alternative because the same level of oversnow visitor access would be provided. However, because visitors riding on snowcoaches would be traveling in groups, wildlife viewing would rarely be a solitary or an individualized experience. If wildlife habituates to the new travel patterns of the snowcoach, wildlife viewing could be improved. Because of the required use of mass transportation visitors would not experience the personal freedom to stop and view wildlife at will.[44]

Opportunities to view scenery. Opportunities to view scenery would not decrease under this alternative because the same level of oversnow visitor access would be provided. However, the nature of the viewing experience for motorized access would change substantially. Visitors who find the personal freedom to stop and view scenery, at will, essential to their park experience would be adversely affected by this alternative.[44] (see discussion under access to winter experiences below).

Safety (the safe behavior of others). Snowcoach-only travel would eliminate the risk of snowmobile accidents and snowmobile/skier conflicts. The general decrease in vehicle miles traveled would necessarily reduce the likelihood of motorized vehicle accidents. In addition there were no large mammals hit or killed by busses or snowcoaches in YNP from 1989 to 1998 (Gunther et al. 1998). Wildlife and snowmobile collisions often result in human injury. Alternative G would result in moderate to major beneficial improvements to visitor safety.

Safety concerns regarding avalanches for both motorized and nonmotorized users would remain the same as alternative A.

Quality of the groomed surface. Both positive and negative effects to the groomed surface would occur under this alternative. The larger tracks of snowcoaches would reduce the overall quality of the groomed surface. However, because the total number of vehicles would be reduced, an improvement in groomed surface quality would be expected.

The availability of access to winter activities or experiences. Oversnow mechanized access would be maintained on all existing groomed routes. Snowcoaches generally travel at lower speeds (about 30 mph to 35 mph) than snowmobiles (40 mph to 45 mph). For visitors who travel from the South Entrance to Old Faithful the slower snowcoach travel time combined with the additional oversnow mileage from Colter Bay would require an additional one hour of travel time each way.

[44] It is important to note that impromptu stops by snowcoaches to view scenery and wildlife are frequent occurrences under current operations and there is no reason to assume that this situation would change.

The removal of snowmobile access into the park would eliminate the current most popular form of winter experience (more than 60% of users) resulting in major adverse effects on snowmobile users.[45]

The late night closure from 11 P.M. to 6 A.M. would result in negligible adverse effects due primarily to visitor inconvenience.

Availability of information. Same as alternative C.

Quiet and solitude. Under alternative G only snowcoaches that can meet strict sound standards would be allowed in the parks. Initially reduction in sound emissions would be moderate; however, as the bombardier snowcoaches, which produce higher sound levels, are retrofitted or phased out, the opportunities to experience quiet will be greatly improved. This alternative would result in major beneficial effects overtime, particularly for nonmotorized users of the parks. Because of the mass transit requirement, options for solitude would be limited for visitors who cannot physically ski or hike.

Backcountry users would be restricted to designated routes in important winter range. This action would result in a higher rate of skier encounters in these areas and limit the range of opportunities currently available to skiers, about 20% of all winter visitors (Littlejohn 1996).

Clean air. Through the permitting process the NPS would require that all snowcoaches meet the highest environmental standards possible for commercially produced mass transit oversnow vehicles. Currently this vehicle is the mat track conversion van. The reductions in vehicle emissions would provide major beneficial improvements in opportunities to experience clean air in YNP.

Conclusion

The reduction in emissions and sound under this alternative would result in direct major beneficial improvements to the experiences of park visitors. There would be a minor to moderate beneficial impact on visitor experience due to increased availability of information, interpretation, and winter programs. There would be no change relative to alternative A in opportunities to view wildlife and scenery, except for backcountry skiers who would experience a minor to moderate decrease in these opportunities in some areas. There would be major beneficial changes relating to safety by eliminating the possibility of snowmobile related motor vehicle accidents.

Under specific circumstances, the adaptive management provisions of this alternative may result in area closures. If monitoring or scientific studies regarding winter visitor

[45] Recent survey data collected by Duffield et al. (2000a) indicates that about 33.4% of non-resident winter visitors would not return to YNP under snowcoach-only management. However, national and regional survey respondents indicated that they favored snowcoach-only access (Duffield et al. 2000c). Similarly, a review of public comment on the DEIS indicates an even split between those who favored snowmobile access and those who favored snowcoach only access. For park visitors who favored snowcoach-only access alternative G would have a positive effect.

use, natural resources, and other park values indicate that sections of the park must be closed or certain uses restricted to protect park values (for example, snowmobiling or backcountry skiing), some or all visitor experiences in the closure area would be eliminated. These areas of closure would result in localized direct adverse impacts to desired winter visitor experience. However, the long-term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

The overall effect of this alternative on the winter visitor experience would be moderate to major and beneficial. However, the elimination of snowmobiles would result in major adverse impacts to the experiences of visitors in this user group. Currently this represents 60% of all winter visitors to the park.

Effects on Visitor Experience — Grand Teton and the Parkway

The amount and type of visitor opportunities offered in GTNP under alternative G are provided in Table 145.

Table 145. Visitor opportunities available under alternative G.

Opportunities	Miles or Areas	Increase/ Decrease	Length of Season	Other
Groomed motorized route	0	-18.2	December to April†	Late night closure
Groomed motorized route, snowcoach	29	25.8	December to April†	Late night closure
Groomed motorized trail	0	-33.9	December to April†	Late night closure
Plowed road	83.4	-16.6	December to April†	Late night closure
Ungroomed motorized trail or area	0	-35.6	December to April†	Late night closure
Groomed nonmotorized	0	0	December to April†	Late night closure
Ungroomed nonmotorized trail or area	27.4	1.0	December to April†	Late night closure
Warming huts/interpretive centers	5	3	December to April†	Late night closure

†Variable, dependent on snow conditions

Visitor Satisfaction and Experience

Opportunities to view wildlife. Same as in alternative B.

Opportunities to view scenery. With the elimination of snowmobile access, and no wheeled-vehicle access north of Colter Bay, there would be fewer opportunities to view scenery by auto and snowmobile. Scenery would be viewed in this area from a snowcoach operating from Colter Bay north to YNP and Flagg Ranch west to Idaho.

Safety (the safe behavior of others). The CDST would be eliminated through GTNP and the Parkway, except for mass transit from Colter Bay to YNP and the west Parkway boundary. This would enhance safety for other nonmotorized uses.

Quality of the groomed surface. Oversnow motorized uses would be eliminated except for snowcoaches. Snowcoaches would operate on a groomed route from Colter Bay into YNP and to the west Parkway boundary.

The availability of access to winter activities or experiences. Access to motorized winter experiences would be decreased except for snowcoaches operating from Colter Bay into YNP and to the west Parkway boundary. There would be a loss of ice fishing opportunities via snowmachine on Jackson Lake. The exclusion of motorized travel from the Lake would also result in limited access to Webb Canyon and other backcountry areas. However nonmotorized use on the Lake would be enhanced. Under this alternative skiing on the groomed surface of the roadway north of Moran Junction would also be available. These actions would particularly benefit local residents who indicated that skiing in the park was their favorite activity (Teton County 1998). However, because of the elimination of wheeled access to Flagg Ranch, park visitors who wish to ski in areas between Moran Junction and Flagg Ranch may (depending on distance) require a snowcoach shuttle for transport.

Availability of information. Same as in alternative D.

Quiet and solitude. With elimination of snowmobile and snowplane use, opportunities for quiet and solitude would be enhanced. The major benefit of this would accrue to nonmotorized uses. There would be a lost opportunity for snowmobilers who are seeking this experience.

Clean air. With elimination of snowmobile use, a major source of pollution would be eliminated. The opportunity to experience clean air would be greatly enhanced under this alternative.

Conclusion

Minor adverse to negligible impacts on visitor experience relating to wildlife and scenery viewing would occur because of the elimination of motorized travel on the frozen surface of Jackson Lake. Opportunities to view wildlife would be improved for nonmotorized users of these areas. There would be major beneficial changes relating to safety by eliminating the possibility of snowmobile-related motor vehicle accidents, and wheeled-vehicle accidents on the road segment from Colter Bay to Flagg Ranch. Improving groomed surfaces would be moderately beneficial for snowcoach use and occupant safety. Overall, there would be a major adverse impact on the availability of access for those who wish to ride snowmobiles or snowplanes. There would be a minor to moderate beneficial impact to visitor experience due to increased availability of information, interpretation, and winter programs. There would be a major beneficial impact relative to opportunities for quiet and solitude. Opportunities to appreciate clean air would be greatly improved. Where oversnow motorized use occurs, via snowcoach, quiet and clean air would be facilitated by improved motorized technology.

The adaptive management provisions of this alternative require that if monitoring or scientific studies regarding winter visitor use, natural resources and other park values indicate that sections of the park must be closed or certain uses (for example, snowmobiling or backcountry skiing) restricted to protect these values, some or all visitor experiences currently afforded in the area of closure would be eliminated (see Appendix L, *Adaptive Management*). These areas of closure would result in direct and localized adverse impacts to desired winter visitor experience. However, the long-term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS ON ADJACENT LANDS

Potential effects on lands within the GYA other than the three national park units is discussed in this section. The US Forest Service (USFS); the States of Wyoming, Montana, and Idaho; and five counties surrounding the park units (all cooperating agencies in this EIS, see Chapter I and Appendix A) provided information for effects analysis in this section. Since the potential for impacts on adjacent lands (apart from economic impacts) is primarily due to possible displacement of winter recreation use from the parks, an analysis of displacement introduces the disclosure of possible impacts.

Possible Conflicts with other Land Use Plans, Policies or Controls

CEQ Regulations (40 CFR 1502.16(c)) require discussion of possible conflicts between the proposed action and objectives of land use plans, policies, or controls for the area concerned. The cooperating agencies represent the jurisdictions in which such conflicts might occur.

The chief concerns expressed by counties, as reflected in their areas of special expertise, have to do with economic impacts of changes in park management (i.e., changes in access or mode of access, and recreational opportunities available from each gateway). Possible effects relating to loss of jobs or income in adjacent communities are disclosed in the *Socioeconomics* section, Chapter IV. Such impacts would not affect local government land use plans, other policies, or controls. This is largely because the essential objectives of park management have not changed, but the means by which they are to be attained could be altered. Teton County, Wyoming, expressed the desire that GTNP would be consistent with the county's new transportation plan. There is nothing in any winter use plan alternative that changes the transportation interface with the county. The park has initiated a separate study effort to review year-round transportation needs in the park related to the county plan.

The States' special expertise extended to resource analyses and recreation. They did not indicate specific conflicts with any plan objectives. However, it can be assumed from their comments that existing snowmobile use does not violate any state or federal standards for air or water quality in or outside the parks. The State of Montana expressed concerns about displaced recreational use and its potential impacts in the areas of safety

and wildlife management. These concerns are discussed in the Montana section below. It can be inferred that if significant use is displaced to state jurisdictional lands, some state objectives might not be met without further management. Wyoming's chief concerns had to do with possible declines in snowmobile tourism to the state through loss of recreational opportunities, and related economic effects. It can be inferred that this would conflict with state level tourism and recreation plan objectives. Similarly, Idaho was concerned about impacts of possible displacement on recreational experience, groomed trail quality, and grooming expense – possibly conflicting with local plans and controls. The NPS has determined that there is no indication of any possible conflict with county land use plans for any alternative because land allocations and basic objectives in the parks would not change significantly.

All adjoining national forests have forest plans in effect, albeit in various stages of revision. In The Winter Visitor Use Management Assessment (GYCC 1999), identifies conflicts relating to winter use. Most conflicts include motorized use and related infrastructure needs, wildlife impacts, and displacement of nonmotorized uses. The assessment indicates that most such conflicts can be handled within the framework of current forest plans, and the rest by forests during upcoming plan revisions. Considering possible displacement of snowmobile use from the parks, the Bridger-Teton National Forest indicates that increased use would destabilize a local balance between nonmotorized and motorized use, and not meet plan objectives. Similarly, the Caribou-Targhee National Forest states that increased use could exceed existing infrastructure and result in the need to amend its new plan. The NPS interprets this conflict as follows for all the forests involved. The forests have standards and guidelines that relate to quality experiences within the spectrum of recreational opportunities. Some forests do not have direction specific to winter use and recreation experience objectives. However, increased use could cause facility capacities to be exceeded. It could also cause heavy trail use that would not meet implied standards for quality use in a given management area. This impact indicates the need for management action to bring use into conformance with the plan – per the analysis in the Winter Visitor Use Management Assessment. The issue is nearly moot since the National Forests indicate they are already at a threshold without any park management changes.

Displacement of Snowmobile Recreation Use to Adjacent Lands

To perform additional effects analysis on forest lands, the USFS requested the NPS to provide information on how use would change in the GYA as a result of each winter use alternative for the parks. The NPS believes that such information is speculative. Many different scenarios can be constructed for the same basic situation, for example, plowing the road from West Yellowstone to Old Faithful. Additional permutations are added when multiple alternatives must be dealt with, and even more when dealing with four major gateways and several other access routes. A partial list of possible considerations follows.

Many nonresident visitors that presently snowmobile in the parks also snowmobile on the adjacent national forests during the same trip. If they cannot snowmobile in the park from the gateway of their choice, they could:

- Continue to visit in future years but spend their time exclusively on national forest lands. The net increase would be the one or two days per trip previously spent in the parks.
- Continue to visit in future years but spend their time on national forest lands as before, and shorten their trip.
- Decline to come to the GYA and forego both national forest and park experiences.
- Continue to visit the GYA, spend as many days on the national forests as they do now and visit the parks using another gateway or a different mode of transport.

Other considerations include the possibility of attracting new visitors with new preferences, and different local users. Some people that have not come to the parks in the past might choose to do so because of available mass transit opportunities, either on plowed roads or groomed, oversnow routes. Such visitors could split their trips to spend a day snowmobiling on the adjacent national forests.

Local snowmobilers would likely continue to use national forest lands as they have in the past. If they can no longer use the parks as they have traditionally done from their local community, they could:

- Enter the parks from another available gateway.
- Leave the region and go elsewhere for one to several trips over the season.
- Curtail their activity overall.
- Spend more time on local national forest lands.
- Visit national forest lands near of other gateways.

The development of a quantified scenario for future recreation use by alternative is speculative. The NPS is in the position of providing a scenario of recreation displacement. The scenario provided represents the most reasonable outcome based on known preferences of current visitors through visitor surveys and current use at each park gateway.[46] Appendix J provides supporting computations for this displacement analysis, including assumptions and methods. Conclusions are presented below.[47]

Alternative A

It is assumed that the existing winter visitor use trends for a given area would continue.

[46] CEQ Regulations at 40 CFR § 1502.22(b) address incomplete or unavailable information. Definitive information about what people would do under a variety of scenarios cannot be obtained. The best available data is from visitor surveys (Duffield, 2000) designed to ask pertinent questions of current winter visitors in the parks. The results indicate what people may do under circumstances posed by key features of EIS alternatives. These surveys are also the basis for impacts described in the socio-economic section and are fully cited therein. Also see Appendix J.

[47] As a cooperating agency, the USFS advocates the use of a worst-case scenario for displacement that might occur in each alternative. The worst-case might be represented by the total amount of park visitation by gateway or otherwise that would no longer be able to use that entrance. What those displaced visitors might do is highly speculative.

Alternative B

- Based on survey responses of current winter visitors about what the visitor would do if the road from West Yellowstone to Old Faithful was available for wheeled-vehicle mass transit only, total visitation to the GYA by nonresidents (snowmobilers, snowcoach riders, and skiers-snowshoers) would be reduced by 18.4%. Nonresidents account for nearly 80% of total visitation in the parks. This reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same but shift their use to other areas of the GYA (e.g., from the parks to the national forests). Total visitation to GYA national parks and adjacent national forests by nonresidents could decrease by that amount. Visitation numbers are unavailable for national forests. However, an wholesale decrease of nonresident visitors by 18.4% could offset or exceed displacement of park use as estimated below (Ref. Economic impacts for alternative B).[48]
- Considering a net decrease in the use of GYA national parks and adjacent national forest lands in this alternative, about 6,700 trips (into the parks annually) are associated with visitors who indicate they would visit the GYA at the same level, but would go to other destinations. Based on the assumption that all the trips involve snowmobiling, a total of about 75 snowmobile trips daily could be displaced to other available lands outside the park near West Yellowstone, to other available areas in the parks, or to other adjacent lands. This would be in addition to resident visitors (accounting for about 20% of park visitation) who currently recreate on adjacent lands much of the time.
- In this alternative, interior roads of GTNP would be closed. Current use consists mostly of local visitors, who could be displaced to the CDST into the Parkway and YNP, or to lands on the Bridger Teton National Forest. About 3,600 snowmobile visits or 45 daily visits could be displaced in this fashion.

Alternative C

- Similar to alternative B, this alternative would also result in a net 18.4% decrease in GYA visitation by nonresidents. In addition early season plowing from the North Entrance could displace about 1,600 visitors during February and 98 during March.
- For GTNP, plowing of the Moose-Wilson Road and Antelope Flats Roads would appear to displace existing negligible use to within the park only. It would be shifted to the proposed east side snowmobile trail.

Alternative D

- The winter use survey asked a question about what the visitor would do if the YNP's East Entrance were closed to snowmobiling, and the road from Colter Bay to Flagg Ranch was not plowed. Based on the response, total visitation by winter visitors living outside the five-county area to the GYA would be reduced by 4.4%. This reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same, but shift their use to other areas of the GYA (e.g., from the parks to the national forests). Total visitation to GYA national parks and adjacent national forests by nonresidents could decrease by that amount. Visitation numbers are unavailable for national forests, but an across the board decrease of 4.4% could offset displacement of park use as estimated below (Ref. Economic impacts for alternative D). Overall, visitation in this alternative would be nearly the same as in alternative A, and very little displacement would occur.
- Considering a net decrease in use in GYA national parks and on adjacent national forest lands in this alternative, about 3,340 snowmobile visits are associated with visitors who enter the park from YNP's East Entrance. A total of about 40 snowmobile trips daily could

[48] The worst-case scenario indicated by the USFS is that the total snowmobile visitation at the West Entrance would be displaced to adjacent lands primarily in the Gallatin, Targhee or Beaverhead-Deerlodge National Forests west of YNP. The average annual visitation is about 56,000 snowmobile passengers through the West Entrance. This equates to an average daily number of snowmobile passengers over the season of about 620 distributed among the three forests.

be displaced to other available lands outside the park near Cody, Wyoming, such as the Beartooth Plateau, or to other available park gateways.[49]

- In this alternative, interior roads of GTNP would be closed. Current use consists mostly of local visitors who could be displaced to the CDST into the Parkway and YNP or to lands on the Bridger Teton National Forest. About 3,600 snowmobile visits or 45 daily visits could be displaced in this fashion.

Alternative E

- Foreseeable use distribution for YNP would be the same as in alternative A, with no net change in visitation to the GYA and no displacement to national forests (Ref. Economic impacts for alternative E).
- In this alternative, interior roads of GTNP would be closed. Current use consists mostly of local visitors, who could be displaced to the Parkway north of Flagg Ranch and YNP, or to lands on the Bridger Teton National Forest. About 3,600 snowmobile visits or 45 daily visits could be displaced in this fashion.[50]
- The CDST trail would be closed through the park. A CDST shuttle service would be provided. Snowmobiling would be allowed only on the Grassy Lake road and north of Flagg Ranch. Most of the use that currently exists on this segment is in transit to Flagg Ranch and YNP's South Entrance. Since this opportunity would remain via shuttle or personal vehicle, none of this use is expected to be displaced to adjacent lands.

Alternative F

- Based on survey responses of current winter visitors about what the visitor would do if the roads from the West and North Entrances to Madison and Old Faithful were closed during the winter, total visitation to the GYA by those who live outside the five-county area would be reduced by 24.6%. Nonresident visitors account for about 80% of park visitation. This reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same, but shift their use to other areas of the GYA (e.g., from the parks to the national forests). This means that total visitation to GYA national parks and to adjacent national forests by nonresidents could decrease by that amount. Visitation numbers are unavailable for national forests, but an across the board decrease of 24.6% could offset or exceed displacement of park use as estimated below (Ref. Economic impacts for alternative F).
- Considering a net decrease in use in GYA national parks and on adjacent national forest lands in this alternative, about 4,000 snowmobile trips into the parks annually are associated with visitors who indicate they would visit in the GYA the same amount, but would go to other destinations. A total of about 50 snowmobile trips daily could be displaced to other available lands outside the park near West Yellowstone, near Gardiner, other available areas in the parks, or other adjacent lands. This would be in addition to resident visitors (accounting for about 20% of park visitation) who currently recreate on adjacent lands.[51]
- In this alternative, interior roads of GTNP would be closed. Current use consists mostly of local visitors, who could be displaced to the Parkway north of Flagg Ranch and YNP, or to lands on the Bridger Teton National Forest. About 3,600 snowmobile visits or 45 daily visits could be displaced in this fashion.
- The CDST trail would be closed through the park. A CDST shuttle service would be provided. Snowmobiling would be allowed only on the Grassy Lake road and north of Flagg Ranch. Most of the use that currently exists on this segment is in transit to Flagg Ranch and YNP's South Entrance. Since this opportunity would remain via shuttle or personal vehicle, none of this use is expected to be displaced to adjacent lands.

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[49] This would correspond with the Forest Service worst-case scenario.
[50] This would correspond with the Forest Service worst-case scenario.
[51] According to the USFS, the worst-case scenario is that the total snowmobile visitation at the West and North Entrances would be displaced to adjacent lands in all the GYA National Forests. The average annual visitation is about 57,500 snowmobile passengers through the West Entrance. This equates to an average of about 675 snowmobile passengers a day to be distributed among the forests throughout the season.

Alternative G

- Based on survey responses of current winter visitors about what the visitor would do if the parks open for snowcoach access only, total visitation to the GYA by those who live outside the five-county area would be reduced by 33.4%. Nonresident visitors account for about 80% of park visitation. Nearly 60% of the visitors who snowmobiled on their trip said they would visit the GYA less frequently. The 33.4% reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same, but shift their use to other areas of the GYA (e.g., from the parks to the national forests). This means that total visitation to GYA national parks and adjacent national forests by nonresidents could decrease by that amount. Visitation numbers are unavailable for national forests, but an across the board decrease of 33.4% could offset or exceed displacement of park use as estimated below (Ref. Economic impacts for alternative G).
- Considering a net decrease in use in GYA national parks and on adjacent national forest lands in this alternative, about 5,230 snowmobile trips (into the parks annually) are associated with visitors who indicate they would visit in the GYA the same amount, but would go to other destinations. A total of about 65 snowmobile trips daily could be displaced to other available lands outside the parks near all gateways. This would be in addition to resident visitors (accounting for about 20% of park visitation) who currently recreate on adjacent lands.[52]

Direct and Indirect Impacts on National Forest Lands

As described in the Chapter III, 51% of the GYA is in the national forest system. About 95% of the perimeter of the three parks abuts national forest lands. A high percentage of the national forest system along this common boundary is in congressionally designated wilderness, and inventoried or other roadless areas. There may be potential impacts to wilderness and inventoried or other roadless areas from programmatic changes in national park management that displaces oversnow motorized use.

Changes in management of the three parks that affect access by personal snowmobile could result in changes in use on adjacent public lands, particularly national forest lands. These lands are already heavily used by snowmobilers, and a number of existing and potential conflicts relating to this use have been identified (GYCC 1999). The USFS indicates that use is generally increasing on forest lands. From the standpoint of the three parks, changes in recreation use on national forests would be an indirect effect of various alternatives for park management.[53] Impacts on national forest lands, wildlife, air, water, or other resources from displaced recreation use are further removed from the source of change. The difficulty in addressing these indirect and tertiary effects is that the impacts associated with possible management changes in the parks are indistinguishable from the impacts of currently increasing use on national forest lands. The most reasonable approach is to consider increased use in the context of cumulative impacts because the magnitude and type of impact from increased use is additive to the amount and type of

[52] According to the USFS, the worst-case scenario is that the total snowmobile visitation in the three park units would be displaced to adjacent lands on all GYA national forests. The average annual visitation is about 84,000 snowmobile passengers through all Yellowstone entrances and within Grand Teton. This equates to an average of about 1,000 snowmobile passengers distributed among the forests throughout the season.

[53] Indirect effect is defined as an effect removed in time or space from the activity that causes the impact.

impact from current snowmobile use. The USFS has not identified any other impact sources, other than displaced winter visitors (snowmobiling and skiing), that would add cumulatively to impacts on USFS lands adjacent to the parks.

Effects Common to all Alternatives

Impacts on the national forests likely would be initiated by a change in the pattern, distribution, or amount of winter recreational use within the parks. The primary indirect effect on the national forest would be a redistribution of the type, amount, and location of use on adjacent forest lands. Other indirect effects may occur on wildlife, recreation special use permittees, recreation quality, facility use, or program administration.

If "clean and quiet" motorized technology were required for parks, decreased sound or emissions could occur on national forests as well. All alternatives except A and C provide for some improvement in technology. The effects of new emission and noise standards for oversnow vehicles could result in cleaner and quieter snowmachines on nearby national forest lands. However, machines that do not meet the new emission and noise standards are likely to continue operating on adjacent national forests, especially on lands more distant from national park entrances, such as those near Lander, Dubois, or Pinedale, Wyoming. Limiting backcountry use in the parks may increase this type of winter use on national forests.

Potential Effects of Recreation Use Displacement on National Forest Lands

Alternative A

The best information source about existing use on National Forests is the 1999 Multi-agency Assessment of Winter Visitor Use. The following descriptions for each GYA forest are based on that assessment.[54]

Beaverhead-Deerlodge National Forest. The Beaverhead Deerlodge NF identified nine areas of conflict involving winter use activities.[55] The major issues relate to heavy use by snowmobiles resulting in crowding (conflicts between snowmobilers), and in displacement of skiers following conflict between those two user groups. Other issues include use of elk winter range, nesting eagles, grizzly bears, wolverines, and motorized trespass. The areas of conflict are shown on a map in the Winter Visitor Use Assessment (GYCC 1999). The forest also notes that there are extensive areas offering backcountry snowmobiling at very low to moderate use levels. Increasing motorized use levels have displaced or are displacing nonmotorized users from the area. This is particularly evident in more easily accessed day-use areas by people engaged in nonmotorized recreation activities.[56] An estimate of total snowmobile use on the forest is unavailable at this time.

[54] A current analysis of existing conditions or impacts from winter use on national forest system lands, including use statistics, is not available. Such information would be important in gauging the impact associated with potential changes in recreation use resulting from the alternatives, using alternative A as the baseline condition.
[55] Greater Yellowstone Coordinating Committee (GYCC), *Winter Visitor Use Management: A Multi-agency Assessment*. 1999. Pages 33-34.
[56] Ibid. Appendix E.

Bridger-Teton National Forest. The Bridge-Teton NF identified 24 areas of conflict involving winter use activities.[57] The major issues relate to heavy use by snowmobiles and cross-country skiers competing for trailhead space and suitable experiences, especially in front country areas. The Shadow Mountain area balances motorized and nonmotorized use precariously, such that any change on the east side of GTNP would disrupt management. This is characterized as conflicts between users (crowding), as well as between user groups. In the latter instance, displacement of skiers follows conflict between motorized and nonmotorized users. In many of the identified issue areas, conflicts are also identified with wintering ungulates, primarily elk and moose. The areas of conflict are detailed and shown on a map in the Winter Visitor Use Assessment. The forest also notes that extensive backcountry areas offer powder, uncrowded play areas, and excellent opportunities for expert snowmobilers and skiers. On many routes, motorized and nonmotorized uses coexist without problems, but concerns exist with routes as crowding increases. The forest notes that there are places where additional parking could be provided to access available terrain and disperse existing use. Use trends indicate that winter recreation is on the increase everywhere on the forest.[58] An estimate of total snowmobile use on the forest is unavailable at this time.

Caribou-Targhee National Forests. Because activity in the sport is increasing, motorized winter use is expected to increase. The annual change is expected to be a 4% to 6% increase based on industry growth rates. There are potential effects on grizzly bears and lynx from increased use. This may require future analysis and consultation by the Targhee NF on specific use areas. In the 1999 assessment the Targhee NF identified 16 areas of conflict involving winter use activities.[59] The major issues relate to heavy use by snowmobiles, resulting in crowding, accidents, impacts on wildlife, and associated with trespass into wilderness or wildlife closures. The areas of conflict are shown on a map in the Winter Visitor Use Assessment (GYCC 1999). The forest also notes that, in the past, the unequal distribution of uses has led to some displacement of nonmotorized users by motorized users. Increased use in all areas has led to conflicts between users. Those wishing a less crowded setting have been pushed further from trailheads and other facilities to find the experiences they are seeking.[60] The Targhee NF estimates current snowmobile use, in concert with Fremont County, Idaho, to be about 300,000 snowmobiler days each year.

Custer National Forest. The Custer NF identified one area of conflict involving winter use activities.[61] This issue concerns wilderness trespass by snowmobiles, and is shown on a map in the Winter Visitor Use Assessment (GYCC 1999). The forest also notes that there are limited opportunities for oversnow motorized use due to difficult access, and low or unreliable snow conditions in most years.[62] It could be assumed that there are

[57] Ibid. Appendix E.
[58] Ibid. Pages 34-35.
[59] Ibid. Appendix E.
[60] Ibid. Pages 41-42.
[61] Ibid. Appendix E.
[62] Ibid. Page 37.

insufficient opportunities on the Custer NF to provide an attraction for displaced use. An estimate of total snowmobile use on the forest is unavailable at this time. However, the forest indicates that snowmobile use in the Cooke City area, the open basin near Crown Butte, is less than 30,000 annually.

Gallatin National Forest. The Gallatin NF identified 24 areas of conflict involving winter use activities.[63] Similar to the Bridger-Teton NF, the major issues relate to heavy use by snowmobiles and nonmotorized uses competing for trailhead space and suitable experiences along trails and routes, and in open areas. This is characterized as conflicts between users (crowding) as well as between user groups. Displacement of skiers often follows conflict between motorized and nonmotorized users. In many of the identified issue areas, conflicts are also identified with wintering ungulates, primarily elk. Several areas are noted for potential conflicts with grizzly bears and eagles. Some areas are characterized by wilderness trespass or entering wildlife closures by motorized vehicles. The areas of conflict are shown on a map in the Winter Visitor Use Assessment (GYCC 1999). The forest also notes the need for change to provide a fairer mix of nonmotorized uses where that category is in short supply or difficult for the public to access. The needed management strategy is to maintain the quality of motorized opportunities while protecting neighboring nonmotorized areas, wintering wildlife, and wilderness as use continues to grow.[64] The Gallatin NF provides estimates of snowmobile use on the Hebgen Lake District and out of Cooke City at an average of 154,840 visitor days from 1995 to 1998.

Shoshone National Forest. The Shoshone NF notes that there is continued growth in motorized winter use on the forest. Continued use conflicts related to snowmobiles are as described in the Winter Visitor Use Assessment, accompanied by a continued need to deal with conflicts using a variety of methods described therein. In the assessment the forest identified 24 areas of conflict involving winter use activities.[65] A variety of types of conflicts are presented, most of which are described as of low to moderate intensity. High levels of conflict are identified for Togwotee Pass and Brooks Lake involving skiers and snowmobilers, crowding, safety, and wildlife impacts. The areas of conflict are shown on a map in the Winter Visitor Use Assessment (GYCC 1999). The forest also notes the need to manage growth in winter motorized use, and the demand for new groomed or upgraded motorized trails (wider groomed surfaces). The forest states that it could accommodate this need by grooming presently marked, ungroomed routes, or by creating new routes in areas presently available for backcountry motorized experiences.[66] An estimate of total snowmobile use on the forest is unavailable at this time.

[63] Ibid. Appendix E.
[64] Ibid. Pages 37-38.
[65] Ibid. Appendix E.
[66] Ibid. Page 40.

Alternative B

Impacts of this Alternative Noted as Common to all GYA National Forests. More stringent standards for snowmobile emissions and noise in the parks would displace non-complying snowmobiles to adjacent national forests in the short term. Long-term effects of more stringent standards might result in development of quieter, cleaner snowmobiles that would also be used on national forests.

Beaverhead-Deerlodge National Forest. The USFS indicates that increased use on the forest might have the following effects. The quality of the snowmobiling experience would be reduced for existing users who prefer a less-crowded experience. There could be an increased impact to trails with resulting reduction in quality of experience or the increased need for trail grooming. Increased pioneering into little used backcountry areas could have corresponding increased impacts on wildlife such as lynx, wolverines, and bald eagles. Increased impacts on wildlife might lead to restrictions on areas and seasons of winter recreation use. Increased conflict between and within recreation user groups could also occur.

However, nonresident visitor trips to the GYA are expected to decrease by 18.4% in this alternative, so the impacts of increased use would likely not be realized from any change in park management. The impacts of current local visitor use would be undiminished, or it may increase to the extent local visitors no longer access the park by snowmobile. The number of nonresidents who would no longer visit the area could more than offset the increase in use by residents for a net decrease in use. The ratio of resident to nonresident use currently experienced on the forest is not known. If nonresident use is a small percentage of total use, then very little change could be expected in comparison to the current condition.

Bridger-Teton National Forest. The USFS states that impacts would be the same as in alternative A. Given the scenario based on the winter use survey, nonresident visitation to the GYA could decrease by 18.4%. There is no definitive information about the ratio of nonresident snowmobilers to resident snowmobilers, but it is likely that a high percentage of use on the Bridger-Teton is from nonresidents. Therefore, in this alternative, use on the forest could decline with overall visitation.

Caribou-Targhee National Forests. The USFS states that the Targhee NF would experience more requests for outfitter and guide activities from operators in the West Yellowstone and Jackson, Wyoming areas in this alternative. USFS states that there would be an expected increase in use on some trails that are not presently heavily used; this could force crowding on all trails in Fremont County, Idaho. Increasing use would force a forest plan amendment to discuss additional use on lynx habitat. The forest would expect an increase in the amount of traffic, currently traveling from Utah to experience the park, to remain in the Island Park area. This would create a safety hazard due to narrow winding trails found on the forest. Increased use may also lead to requests

to modify trails as an accommodation. Some destination users for the park could visit Old Faithful and still snowmobile in the national forest as part of the overall experience.[67]

However, nonresident visitor trips to the GYA are expected to decrease by 18.4% in this alternative, so the impacts of increased use would likely not be realized from any change in park management. The impacts of current local visitor use would be undiminished, or it may increase to the extent local visitors no longer access the park by snowmobile. The number of nonresidents who would no longer visit the area could more than offset the increase in use by residents for a net decrease in use. The ratio of resident to nonresident use currently experienced on the forest is not known.

Custer National Forest. This alternative would minimally affect the Custer NF. While plowing the West Entrance access could cause a shift in nonresident usage, the Beartooth area or other parts of the Custer would be minimally affected. Since much of the current use is from the resident population, use would not be expected to increase or decrease significantly.

Gallatin National Forest. The Gallatin NF states that effects could be substantial, creating potential impacts to wintering big game, threatened and endangered species, and exacerbating already growing recreation health and safety issues, trespass into closed areas, taxing existing infrastructure and heightening recreation user conflicts. However, nonresident visitor trips to the GYA are expected to decrease by 18.4% in this alternative, so the impacts of increased use would likely not be realized from any change in park management. The impacts of current local visitor use would be undiminished, or it may increase to the extent local visitors no longer access the park by snowmobile. The number of nonresidents who would no longer visit the area could more than offset the increase in use by residents for a net decrease in use. The ratio of resident to nonresident use currently experienced on the forest is not known.[68]

Shoshone National Forest. Nonresident visitor trips to the GYA are expected to decrease by 18.4% in this alternative, so the impacts of increased use would likely not be realized from any change in park management. The impacts of current local visitor use would be unchanged because access to the parks from the Shoshone NF would not change. That is, access would remain through YNP's East Entrance, the CDST and YNP's South Entrance. The number of nonresidents who would no longer visit the area could more than offset the local redistribution of use by residents for an overall net decrease in use. There is a potential for users who could not use the West Entrance to come to the East Entrance instead. This redistribution would not affect forest lands. The potential for redistribution of nonresident use to the southern portion of the Shoshone NF,

[67] General public use of the plowed road by personal vehicle would not be available as part of this alternative.
[68] The worst-case scenario would be that in which all West Entrance snowmobile users would continue to come to the GYA but not enter the parks at any other gateway and use only adjacent lands. The average annual access by snowmobiles through the West Entrance is about 56,000 snowmobile passengers. Over a season, this equates to about 620 snowmobile passengers per day distributed possibly among the Gallatin, Targhee and Beaverhead-Deerlodge forests on the west side of Yellowstone.

thus increasing use on Togwotee Pass, is possible but not likely because of the overall decrease in use by nonresidents.[69] Should there be a local redistribution of this type, the effect would be to exacerbate the existing motorized use conflicts in that area which relate primarily to snowmobile crowding and displacement of nonmotorized users as shown in alternative A.

Alternative C

Impacts of this Alternative noted as common to all GYA Forests. Potential displacement of recreation use from the parks is very much the same as in alternative B. That is, an overall reduction of nonresident visitor use to the GYA of 18.4% is expected based on the survey of current winter visitors. The USFS states that in this alternative, the elimination of the loop route in YNP in mid-February (from an early season plowing) could inordinately affect the forests by displacing motorized use to them during times that are critical for wildlife (spring bear emergence, lynx, wolverines, nesting bald eagles, and moose winter range).[70] Any displaced use that causes local increases near denning habitat for bears may be of concern during both the winter and the spring use period.

Beaverhead-Deerlodge National Forest. Effects of increased use on the forest could be similar to those outlined for alternative B above.

Bridger-Teton National Forest. With respect to access into YNP and GTNP, this alternative is not materially different from alternative B the impacts as noted in that alternative would apply here as well. The USFS states that impacts would be the same as in alternative A. Considering the scenario based on the winter use survey, nonresident visitation to the GYA could decrease by 18.4%. There is no definitive information about the ratio of nonresident snowmobilers to resident snowmobilers, but it is likely that a high percentage of use on the Bridger-Teton NF is from nonresidents. Therefore, in this alternative, use on the forest could decline with overall visitation.

The major difference in this alternative from current management in GTNP is the proposed east side snowmobile trail between GTNP's south boundary and Moran. Use of this trail could affect existing nonmotorized uses on the national forest east of the park. However, existing access by passenger car to the Shadow Mountain trailhead would remain the same as at present to facilitate multiple use access to national forests from the park. Any significant use of the new snowmobile trail could displace cross-country skiers from the Shadow Mountain area, one of the most popular ski trails in Jackson Hole. The USFS states that this would not be compatible with forest objectives; the

[69] There is no quantified estimate of total use on Togwotee Pass. The worst-case scenario is that a portion of the 56000 annual snowmobile passengers no longer using the West Entrance would come to the Shoshone as well as the other west GYA forests, and not reenter the parks.

[70] NPS notes that there is no supporting information associated with this statement, and that it is a statement contributed generically by most of the GYA forests. Considering that there is no recent forest data regarding the current condition that would indicate any concern about present use on the forests regarding wolverines, eagles or lynx, there appears to be a suggestion that only use displaced from the parks is of concern. It should be noted that all forests also indicate that use is increasing on NF lands, such that without any changes in park management there would still be a concern about such impacts.

Bridger-Teton NF offers little opportunity for family skiing and easy terrain. Offered areas (Cache Creek, Shadow Mountain, a few other places) are also used increasingly by snowmobiles.

Caribou-Targhee National Forests. The Caribou-Targhee NF states that an increase in the amount of traffic that currently travels from Utah to experience the park would in this alternative (as in alternative B) remain in the Island Park area to continue the sport of snowmobiling. Should this happen, it would create a safety hazard due to narrow winding trails found on the forest. Increased use may also lead to requests to modify trails to accommodate increased use. Due to the plowing of the roads in the park from the north in the late season, an increase in the number of users from the eastern states would be expected. Access to the West Yellowstone and Island Park area becomes easier during the prime part of the season. With any local increase in use, the Ashton area of the Targhee NF could expect more snowmobile traffic over the Ashton Flagg Ranch road, past Mesa Falls to Island Park, as this would become the major access snowmobile route coming from the east and terminating in West Yellowstone. Increased use over the Flagg Ranch Road and expected late season snowmobile traffic coming through the park from the eastern states may have effects on lynx habitat. With increases in local use, the Targhee NF states that it could experience more requests for outfitter and guide activities from operators in the West Yellowstone and the Jackson Hole areas. Use would be expected to increase on some trails not presently heavily used. This could force all trails to be crowded in Fremont County, Idaho. Increasing use would force a forest plan amendment to discuss additional use on lynx and habitat.

Considering the scenario based on the winter use survey, nonresident visitation to the GYA could decrease by 18.4% and the potential impacts described above would not materialize since most are related to visitation from outside the GYA.

Custer National Forest. Impacts on the Custer NF would be the same as in alternative B, in which there is a negligible change from the current management situation.

Gallatin National Forest. The impacts of alternative C would be the same as those described in alternative B, with one exception. The USFS states that the late season plowing from Mammoth to Madison could locally displace use to the Cooke City vicinity. Given the scenario from the winter use survey responses, any such displacement would primarily affect resident snowmobilers. The overall reduction of nonresident visitors by 18.4% could offset any local redistribution of use.

Shoshone National Forest. Impacts on the Shoshone NF would be the same as in alternative B, in which there is a negligible change from the current management situation.

Alternative D

Beaverhead-Deerlodge National Forest. Since access to YNP from the north, west, and south do not change from current management in this alternative, there would be no

concerns about effects of increased use on the forest. The minimal amount of local redistribution of use from the closed East Entrance is not likely to be displaced to the Beaverhead-Deerlodge NF. The USFS states that prohibition of night use in the parks in this alternative could increase night use on the Beaverhead-Deerlodge NF. Night use in backcountry of the national forest would have a greater safety risk than night use on the well-groomed and marked trails of the parks.[71]

Bridger-Teton National Forest. Since access to YNP from the north, west, and south do not change from current management in this alternative, there would be no concerns about effects of increased use on the forest. The minimal amount of local redistribution of use from the closed East Entrance is not likely to be displaced to the Jackson, Wyoming area except for the small portion of it that relates to nonresident visitors. The USFS states a concern about redistribution of local skiing use by people who engage in that activity by wheeled-vehicle access along the Colter Bay to Flagg Ranch road segment. In this alternative, GTNP does not plow the road from Colter Bay to Flagg Ranch. However, most of GTNP would be available for nonmotorized use without motorized conflicts, and there are possibilities for facilitating nonmotorized use between Colter Bay and Flagg Ranch using snowmobile or snowcoach shuttle access. There is no expectation that any nonmotorized use would be displaced, or that it would be displaced to adjacent lands.[72]

Access via motorized means to private inholdings and adjacent private and public lands would be maintained along the eastern boundary of GTNP. For adjacent public lands, this applies primarily to those on the east side of the park including access to Shadow Mountain and access near the Triangle X Ranch. Maintenance of this access would not affect the balance of motorized and nonmotorized use in the Shadow Mountain area. See *Actions and Assumptions Common to All Alternatives* in this EIS.[73]

Caribou-Targhee National Forests. The USFS expects effects similar to the no action alternative covering numbers of users. Prohibition of night use in the parks could increase night use on the Island Park district, exacerbating existing problems.[74]

Custer National Forest. Closing the East Entrance could increase snowmobile use in the Beartooth and Cooke City areas. Topographic features and wind blown areas in the Beartooth Mountains on the Beartooth Ranger District currently limit the potential for

[71] If night use presently occurs, and is a safety hazard, it is not reasonable to attribute this impact solely to possible changes in park management.
[72] The Forest Service states that most of the skiers in this area are coming from Jackson and their primary destinations in the Colter-Flagg area are Colter Bay/Hermitage Point, Flagg Canyon, Huckleberry and Polecat Hot Springs, and Huckleberry Mountain. Because the lookout and hot springs are primary destinations, these skiers don't have an alternative that would meet the same desires, so it's hard to say where they would be displaced to. If snowcoach transport were available and affordable, it would be possible to reach trailheads in the Flagg Ranch area for skiing, and a few people who own snowmobiles would still be able to access these areas.
[73] It was not made clear in the DEIS that such access would be maintained.
[74] If night use presently occurs, and is a safety hazard, it is not reasonable to attribute this impact solely to possible changes in park management.

even moderate increases in new snowmobile play use areas, however, use could increase along existing trails. To the extent that the East Entrance use comes from nonresident visitors, total visitation on the east side of YNP is most likely to decrease. This amount is some percentage of the average annual 3,340 snowmobile trips, or 40 daily trips. To the extent that this use is attributed to resident visitors, again something less than 40 daily trips, this amount could be displaced to the Beartooth area.

Increased use of something less than 40 snowmobile visits per day along existing trails in the Red Lodge and lower Stillwater River area, and especially in areas of the Custer NF adjacent to Cooke City would be expected. The headwaters of the Stillwater River on the Custer NF, near Cooke City would likely receive increased use, particularly the play area associated with the open grassland basin near Crown Butte. Should all use from the East Entrance be displaced to the Crown Butte area, with an estimated existing snowmobile use of 30,000 (or less) round trips per year in the basin, this would be an increase of just over 1%. This increase would be an upper bound on the estimate for reasons discussed above. Snowmobile use is restricted to non-wilderness areas. Wilderness trespass by snowmobile users is currently a problem that could increase with additional use in the area.

Gallatin National Forest. Since access to YNP from the north, west, and south do not change from current management in this alternative, there would be little concern about effects of increased use on the forest. The minimal amount of local redistribution of use from the closed East Entrance (less than 40 snowmobile trips per day on the average) could be displaced to the Cooke City area, where parking and grooming infrastructure is currently taxed. Additional use pressure at Cooke City could also exacerbate wilderness trespass issues that have grown substantially in recent years. Prohibition of night use in the parks could increase night use on Hebgen Lake district, exacerbating existing problems.

Shoshone National Forest. The USFS is concerned that this alternative could close Pahaska Lodge (located outside YNP's East Entrance) during the winters. Pahaska Lodge now has a considerable number of year-round employees, which allows it to maintain a stable and conscientious work force. Forcing this operation to a summer-only operation would cause considerable disruption for the owners and employees. The Pahaska-East Entrance is also the location of the majority of Park County's nordic skiing trail system. Pahaska gets the majority of its overnight use from snowmobilers, those starting at the East Entrance or those coming from the West Entrance to stay overnight and returning. Without snowmobiler overnight lodging or rentals, there is a high likelihood that the nordic opportunities in the Pahaska area would also close.

Lack of access through the East Entrance would likely displace a minimal amount (less than 40 snowmobile trips per day) of motorized use to Cooke City, Sunlight Basin, and the Beartooth Plateau, where conflicts presently exist or resource concerns have been identified. Some use could also be displaced to the Bighorn NF where motorized

recreation use has been increasing. It could also significantly affect the operation at Pahaska Tepee Lodge (snowmobile rentals and winter stays), and other North Fork lodges that have been gearing toward winter motorized use in recent years. East Entrance motorized use cannot be relocated to the national forest in areas presently accessible via these same lodge facilities due to the near presence of wilderness and the lack of suitable snow and terrain.

Alternative E

Impacts of this Alternative noted as common to all GYA Forests. The USFS states that there is a range of possible effects and outcomes associated with the adaptive management alternative, and that this presents a challenge for determining the possible effects on national forests.[75] Given there is a potential for management changes in this alternative due to adaptive management, the foreseeable impacts in alternative E would be the same as in alternative A for YNP. Management changes in GTNP are evident in the alternative description apart from possible future changes due to adaptive management.

Beaverhead-Deerlodge National Forest. The impacts would be the same as in alternative A. The effect of eliminating the CDST from GTNP's East Entrance to Flagg Ranch would not result in use redistribution that could affect the Beaverhead-Deerlodge NF.

Bridger-Teton National Forest. Foreseeable use distribution for YNP would be the same as in alternative A, with no net change in visitation to the GYA and no displacement to national forests (Ref. Economic impacts for alternative E).

The USFS expresses concerns about local displacement of recreation use from changes in motorized use opportunities within GTNP. In this alternative, interior roads of GTNP are closed. Current use consists mostly of local visitors, who could be displaced to the Parkway north of Flagg Ranch and Yellowstone, or to lands on the Bridger Teton NF. About 3,600 snowmobile visits or 45 daily visits could be displaced in this fashion.[76]

The CDST trail is closed through the park except for provided shuttle service; snowmobiling is allowed only on the Grassy Lake road and north of Flagg Ranch. Most of the use that currently exists on this segment is in transit to Flagg Ranch and YNP's South Entrance. Since this opportunity remains via shuttle or personal vehicle, none of this use is expected to be displaced to or remain on the Bridger-Teton NF. Average daily use on the CDST coming from GTNP's East Entrance is 24 snowmobiles (including round trip use). Peak day use is 43 machines. There is no available estimate of total or

[75] Some effects of this alternative would be disclosed by looking at effects in pieces of other alternatives. However, there may be other sensitive areas that could now be identified, or would arise through future monitoring where closures or other restrictions have not been anticipated. A worst-case assessment, shifting significant amounts of use to national forests, raises secondary issues such as ungulate habitat or T&E species, and burgeoning recreational user conflicts. The FS states that it is not sure what the consequences of this would be.

[76] This would correspond with the Forest Service worst-case scenario.

daily use on Togwotee Pass, but it is reasonable to assume that 24 snowmobile trips per day, should it remain on Togwotee, is not a significant percentage of daily use in that area.[77]

Caribou-Targhee National Forests. Conditions would be the same as in alternative A. Management in YNP is unchanged in the foreseeable future, and access through GTNP and into Flagg Ranch from the west would not change. Changes in visitation, up or down, are not anticipated, therefore, there would be no displacement effect to consider.

Custer National Forest. Conditions would be the same as in alternative A. Management in YNP is unchanged in the foreseeable future, and access through GTNP and into Flagg Ranch from the west would not affect the Custer NF. Changes in visitation, up or down, are not anticipated, therefore, there would be no displacement effect to consider.

Gallatin National Forest. Conditions would be the same as in alternative A. Management in YNP is unchanged in the foreseeable future, and access through GTNP and into Flagg Ranch from the west would not affect the Gallatin NF. Changes in visitation, up or down, are not anticipated, therefore, there would be no displacement effect to consider.

Shoshone National Forest. The forest notes no additional or specific impacts. See effects for the Bridger-Teton NF, in which the forest is concerned about possible increases in use on Togwotee Pass due to the closure of the CDST through GTNP.

Alternative F

Impacts of this Alternative noted as common to all GYA Forests. The USFS is concerned that if the parks close to dispersed backcountry use (except on designated routes) an inordinate effect on adjacent national forest wildlife habitat from displaced use could occur. They state that with presently limited access for that type of use on forests, except to areas that are generally closed for wildlife purposes, increased human-crucial winter range habitat conflicts and increased conflicts between user groups would be anticipated. Backcountry closures in alternative F for YNP could displace this type of use. NPS estimates displacement of backcountry nonmotorized use to be about 840 visitors per year. Based on the winter use survey results, about 5% of these users would or may continue to visit the GYA to engage in this use. In this alternative, using the survey assumptions, an estimated 42 skiers annually would be displaced to surrounding

[77] The FS is concerned about infrastructure (trailhead parking, restrooms, trail capacities) limitations on the Bridger Teton and Shoshone over Togwotee pass and in other locations. Trailheads are already full and people are parking on the highway margins. The FS is pursuing what opportunities exist to enlarge a few of the parking areas, but this won't meet the need if significant average amounts of use are displaced from the park to adjacent lands. FS believes that this alternative would force many Togwotee Pass users to stay on the forest rather than use a shuttle system to Flagg Ranch. FS states that users with their own machines or rentals would be more likely to use the forest in the Togwotee area, or drive to Flagg and start their park trip there. Because snow and trail conditions on the CDST in the park (especially around Moran) aren't very good, FS believes most users already use the forest because of better snow and more trails.

national forests or to GTNP, since backcountry use would not be restricted there in this alternative.

The USFS is concerned that if bison exit the park because of availability of groomed routes, and if those routes are no longer available to the west and north where much of the movement presently occurs, then there could be a significant movement of bison along south and east routes onto national forests. With reference to the analysis of alternative F on bison, most of the bison migration from YNP on the north and west does not occur on groomed routes. Therefore, eliminating groomed routes would have little if any impact on migration patterns.

Beaverhead-Deerlodge National Forest. The impacts of this alternative would not be greatly different from those shown in alternatives B and C, except that nonresident visitor trips to the GYA are expected to decrease by 24.6 % instead of 18.4% in this alternative. Given this assumption, the impacts of increased use would be even less likely from any change in park management.

Bridger-Teton National Forest. Nonresident visitor trips to the GYA are expected to decrease by a net 24.6% in this alternative, accounting for visitors who said they would shift their use to other areas in the GYA or would visit more. The impacts of current resident visitor use on the forest would be undiminished. The local redistribution of use by some nonresident snowmobilers who would continue to visit the GYA could continue to access the parks via the South or East Entrances. This could be offset by an overall decrease in nonresident visitor use to the area.[78] Local redistribution, using the winter survey results, show 50 snowmobile trips daily could remain in the West Yellowstone and Gardiner areas, or access the parks through the South and East Entrances. Considering total existing use in all areas, this would not be a significant displacement impact in the Jackson area or on the Bridger-Teton NF.

Caribou-Targhee National Forests. Snowmobile use on the national forest would be similar to alternatives B and C with implementation of this alternative. Nonresident visitor trips to the GYA are expected to decrease by a net 24.6% in this alternative, accounting for visitors who said they would shift their use to other areas in the GYA or would visit more. The impacts of current resident visitor use on the forest would be undiminished. Since much of visitation on this forest comes from nonresidents, it could be expected that the decrease in GYA nonresident visitation would be absorbed largely on the Targhee NF. Local redistribution, using the winter survey results, show 50 snowmobile trips daily could remain in the West Yellowstone and Gardiner areas, or access the parks through the South and East Entrances (via Flagg Ranch and Afton).

[78] FS is concerned that a great deal of additional use at South Entrance would engender additional use in the Moran-Togwotee area. The worst-case scenario involves about 675 daily snowmobile trips distributed to forest lands on the Gallatin, Targhee, Beaverhead-Deerlodge, or to the South and East Entrances of Yellowstone with ancillary use occurring on the Custer, Shoshone and Bridger-Teton.

Considering total existing use in all areas, this would not be a significant displacement of use to the Targhee NF, within the context of an overall decrease in nonresident use.

Custer National Forest. Snowmobile use on the national forest would be similar to alternatives B and C with implementation of this alternative. Nonresident visitor trips to the GYA are expected to decrease by a net 24.6% in this alternative, accounting for visitors who said they would shift their use to other areas in the GYA or would visit more. The impacts of current resident visitor use on the forest would be undiminished. Local redistribution, using the winter survey results, show 50 snowmobile trips daily could remain in the West Yellowstone and Gardiner areas, or access the parks through the South and East Entrances. Considering total existing use in all areas, this would not be a significant displacement of use to the Custer in the Beartooth and Cooke City areas.

Increased use of something less than 50 snowmobile visits per day in areas of the Custer NF adjacent to Cooke City would be expected. The headwaters of the Stillwater River on the Custer NF, near Cooke City would likely receive increased use, particularly the play area associated with the open grassland basin near Crown Butte. Should all use from the North and West Entrances be displaced to the Crown Butte area, with an estimated existing snowmobile use of 30,000 (or less) round trips per year in the basin, this would be an increase of between 1% and 2%. This increase would be an upper bound on the estimate since nonresident use is more likely to decrease or go elsewhere in the GYA. Snowmobile use is restricted to non-wilderness areas. Wilderness trespass by snowmobile users is currently a problem that could increase with additional use in the area.

Gallatin National Forest. Snowmobile use on the national forest would be similar to alternatives B and C, except that nonresident visitor trips to the GYA would be expected to decrease by a net 24.6% in this alternative instead of 18.4%. This would be a net reduction, accounting for visitors who said they would shift their use to other areas in the GYA or would visit more. The impacts of current resident visitor use on the forest would be undiminished. Local redistribution, using the winter survey results, show 50 snowmobile trips daily could remain in the West Yellowstone and Gardiner areas, or access the parks through the South and East Entrances. Considering total existing use in all areas, and the overall decrease in nonresident visits to the GYA, this would not result in a significant displacement of use to the Gallatin NF. If the displaced use were to come to the Cooke City area of the Gallatin, it would represent less than 1% of the estimated 45,000 to 60,000 snowmobiles that annually use the area.[79]

[79] Source: Ron Gardner, and Kimberly Schlenker, Gallatin N. F., April 6, 2000. FS is concerned that a great deal of additional use would be displaced to the Gallatin. The worst-case scenario involves about 675 daily snowmobile trips distributed to forest lands on the Gallatin, Targhee, Beaverhead-Deerlodge, or to the South and East Entrances of Yellowstone. FS states that on the Gallatin, human-crucial winter range habitat conflicts could be anticipated, with potential impacts to wintering big game, T&E species, and exacerbating already growing recreation health and safety issues, trespass into closed areas, taxing existing infrastructure and increasing recreation user conflicts.

Shoshone National Forest. Nonresident visitor trips to the GYA are expected to decrease by 24.6% in this alternative, so the impacts of increased use would likely not be realized from any change in park management. The impacts of current local visitor use would be unchanged because access to the parks from the Shoshone NF would not change. Access would remain through YNP's South and East Entrances. The number of nonresidents who would no longer visit the area could more than offset the local redistribution of use by residents for an overall net decrease in use. There is a potential for users who could not use the West and North Entrances to come to the East Entrance instead. This redistribution would not be expected to affect forest lands due to the lack of available snowmobiling adjacent to it. The potential for redistribution of nonresident use to the southern area of the Shoshone NF, increasing use on Togwotee Pass, is possible but not likely because of the overall decrease in use by nonresidents.[80] Should there be a local redistribution of this type, the effect would be to exacerbate the existing motorized use conflicts in that area which relate primarily to snowmobile crowding and displacement of nonmotorized users as shown in alternative A.

Alternative G

Impacts of this Alternative noted as common to all GYA National Forests. An overall reduction of nonresident visitor use to the GYA of 33.4% is expected based on the survey of current winter visitors. This percent reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same, but shift their use to other areas of the GYA (e.g., from the parks to the national forests). This means that total visitation to GYA national parks and to adjacent national forests by nonresidents could decrease by that amount. Visitation numbers are unavailable for national forests, but an across the board decrease of 33.4% could offset or exceed local displacement of park use. Within the context of an overall decrease in nonresident use, there could be a redistribution of those nonresident visitors who continue to come to the GYA. Based on survey results, this amounts to about 65 snowmobile trips daily distributed among all the GYA forests. Considering total existing use on GYA forests, this amount would appear to be insignificant.

The USFS is concerned that increased use on forests as a result of displaced park use could inordinately affect the forests in areas and during times that are critical for wildlife (spring bear emergence, lynx, wolverines, nesting bald eagles, moose winter range).[81]

[80] There is no quantified estimate of total use on Togwotee Pass. The worst-case scenario is that a portion of the 56,000 annual snowmobile passengers no longer using the West Entrance would come to the Shoshone as well as the other west GYA forests, and not reenter the parks.

[81] Considering that there is no recent forest data regarding the current condition that would indicate any concern about present use on the forests regarding wolverines, eagles or lynx, there appears to be a suggestion that only use displaced from the parks is of concern. It should be noted that all forests also indicate that use is increasing on NF lands, such that without any changes in park management there would still be a concern about such impacts.

Any displaced use that causes local increases near denning habitat for bears may be of concern during both the season and the spring use period.[82]

Beaverhead-Deerlodge National Forest. An overall decrease of 33.4% in nonresident use of both park and forest lands in the GYA is expected based on the survey of current winter visitors. In this event, there would be no net increase in use of the forest, and quite possibly a decrease. The amount of use associated with local residents would remain, or increase to the extent it no longer occurs in the parks.

Bridger-Teton National Forest. The USFS states that permittees on the Bridger-Teton NF with snowmobile use have already asked about additional use days for the CDST and other trails near Togwotee (where use is at capacity now). Requests have been received from outfitters who currently don't use that area but are looking for someplace to take clients if their use in YNP is curtailed. The forest is apparently over capacity in winter sports now in the Togwotee area, the Gros Ventre, and upper Green River. Places used less frequently a few years ago, such as Horse Creek in the Wyoming Range and the Greys River, are under increasing demand. Even without any management changes in the parks, use levels that are compatible with the desired experience and setting are being surpassed.

An overall decrease of 33.4% in nonresident use of both park and forest lands in the GYA is expected, based on the survey of current winter visitors. In this event, there would be no net increase in use of the forest, and quite possibly a decrease thus relieving the current impacts stated by the USFS. The amount of use associated with local residents would remain, or increase to the extent it no longer would occur in the parks.

Caribou-Targhee National Forests. The Targhee NF states concerns about an increase in users and their expectation for groomed trail riding experiences. There are concerns about possible increased demand for outfitted rides and about an increase in the displacement of off trail users that currently access the area from the south and east. The USFS states that users would stop in the Ashton-Island Park area to access the backcountry rather than travel to West Yellowstone. Other increases in use could result from people coming to the area for experiences similar to those currently available in the park.

An overall decrease of 33.4% in nonresident use of both park and forest lands in the GYA is expected, based on the survey of current winter visitors. In this event, there would be no net increase in use of the forest, and quite possibly a decrease thus relieving the current impacts stated by the USFS. The amount of use associated with local residents would remain, or increase to the extent it no longer would occur in the parks.

[82] The worst-case scenario indicated by the Forest Service is that the total snowmobile visitation in the three park units would be displaced to adjacent lands on all GYA national forests. The average annual visitation is about 84,000 snowmobile passengers through the all Yellowstone entrances and within Grand Teton. This equates to an average daily number of snowmobile passengers over the season of about 1000 to be distributed among the forests. Visitation data for all the forests is unavailable for comparison purposes.

Custer National Forest. The USFS states that additional vehicles associated with snowmobile users would likely be parked at trailhead locations and create increased demands for parking facilities. Some additional car and truck traffic would occur along plowed roads to trail heads. Many of these trails traverse big game winter range and some additional vehicle-large animal collisions could occur. The period of snowmelt is expected to increase by an additional 10 to 14 days on roads on which the snow is compacted by snowmobiles versus areas where no snow compaction occurs. Also, the forest is concerned that the Pryor Mountains could receive some additional use by snowmobiles. Most use would be expected to follow existing trails or occur in existing play areas. Displaced snowmobile activity would not be expected to go to the Ashland or Sioux Ranger Districts.

An overall decrease of 33.4% in nonresident use of both park and forest lands in the GYA is expected, based on the survey of current winter visitors. In this event, there would be no net increase in use of the forest, and quite possibly a decrease thus relieving or offsetting impacts of concern to the USFS noted above. The amount of use associated with local residents would remain, or increase to the extent it no longer would occur in the parks.

Gallatin National Forest. Effects of large amounts of use displaced to the forest could be substantial: creating potential impacts to wintering big game and threatened and endangered species; exacerbating already growing recreation health and safety issues and trespass into closed areas; taxing existing infrastructure; and heightening recreation user conflicts.

An overall decrease of 33.4% in nonresident use of both park and forest lands in the GYA is expected, based on the survey of current winter visitors. In this event, there would be no net increase in use of the forest, and quite possibly a decrease thus relieving or offsetting impacts of concern to the USFS noted above. The amount of use associated with local residents would remain, or increase to the extent it no longer would occur in the parks.

Shoshone National Forest. The USFS is concerned that this alternative could close Pahaska Lodge (located outside YNP's East Entrance) during the winters. Pahaska Lodge now has a considerable number of year-around employees, which allows it to maintain a stable and conscientious work force. Forcing this operation to a summer-only operation would cause considerable disruption for the owners and employees. The Pahaska/East Entrance is also the location of the majority of Park County's nordic skiing trail system. Pahaska gets the majority of its overnight use from snowmobilers, those starting at the East Entrance or those coming from the West Entrance to stay overnight and returning. Without snowmobiler overnight lodging or rentals, there is a high likelihood that the Nordic opportunities in the Pahaska area would also close.

The Shoshone NF is also concerned that use on Togwotee Pass and the CDST area would greatly increase. Increased use would exceed current infrastructure capacity (see Bridger-Teton NF alternative G discussion) and exacerbate current identified conditions of crowding and nonmotorized use displacement. Reconstructing or creating additional facility capacity would be an extreme and unfinanced burden for the USFS.

A decrease of 33.4% in nonresident use of both park and forest lands in the GYA is expected, based on the survey of current winter visitors. In this event there would be no net increase in the use of the forest, and possibly a decrease thus relieving or offsetting impacts of concern to the USFS. The amount of use associated with local residents would remain, or increase to the extent that it no longer would occur in the parks. The USFS indicates there would be a strong potential for increased snowmobile use on the Bighorn NF.

Effects on Other Federal Lands

As described in the Chapter III, 5% of the GYA within other federal agency jurisdictions (BLM, USFWS, and Bureau of Reclamation(BOR)). Lands under these jurisdictions typically are not adjacent to the national parks. The potential impacts of programmatic changes in national park management are low. Jurisdictional BOR lands associated with Jackson Lake and Jackson Lake Dam would not be affected in any alternative more than now. Alternatives that reduce or eliminate motorized use on Jackson Lake would be beneficial from the standpoint of reducing any present impacts on BOR lands. The National Elk Refuge abuts GTNP along its southeastern boundary. Because of the timing of elk migration in the winter use season, none of the alternatives would have an adverse impact greater than that which presently may exist. Current snowmobile use in the GYA occurs on some BLM lands, for example, in places along the CDST. Most BLM lands lie outside the areas that are capable of annually supporting snowmobile use because of unsuitable snow. Changes in management represented by the range of alternatives in this EIS would not affect marginally available snowmobiling on BLM lands. Generally, any impacts on the national forests (should they occur) would buffer effects on other federal lands, which do not have the capability to support great amounts of winter recreation on snow.

Effects on Tribal Lands and Governments

As described in the Chapter III, 4% of the GYA is within the jurisdiction of tribal or American Indian governments. These lands are not immediately adjacent to the national parks, and they are not legally accessible to the general public. The potential for physical impacts on changes in national park management are low. These lands would not be subject to any redistribution of use, nor would they appear to be indirectly affected by possible impacts on national forests. Generally, impacts on the forests would buffer effects, if any, on tribal lands or governments.

Direct and Indirect Effects on States and Counties

As described in the Chapter III, 3% of the GYA is state-owned lands. Some Montana state land sections are intermingled with Gallatin NF lands north of YNP. See *Effects on the State of Montana* below. Five counties are affected through gateway communities for the three park units. In the area described as the GYA, 24% is in private ownership. However, very little of that private land directly abuts YNP, GTNP, or the Parkway. Private inholdings constitute less than 1% of the GTNP land base. Most of the private lands lie within the exterior boundaries of adjacent national forests in areas that are marginally suited for oversnow motorized use. As such, they would not directly or indirectly be affected by any of the alternatives being considered. Through the scoping period, and in the large volume of comments on the DEIS, no concerns or issues were raised about possible impacts on private lands.

Effects on the State of Wyoming

There would be no impacts on state lands or private lands in Wyoming adjacent to the parks. The NPS determined that there would be no impacts on these lands based on the best available information about how overall use from nonresident visitors to the GYA would either remain the same or decline through the range of alternatives. Any state or private land near winter uses would have similar or less pressure. No such effects were identified by the State of Wyoming.

Alternative A

The State of Wyoming identified no impacts associated with alternative A. The NPS notes that a number of statements made regarding air, water, and wildlife apply to the existing condition, not to what may happen as a result of other alternatives.

Alternative B

Water Quality. The State notes that any alternative involving an increase in road use and maintenance in the parks could affect surface waters during spring runoff. The State further notes that the parks should consider impacts to surface waters due to plowing, sanding, or improper snow removal, and that snow storage sites should be carefully sited so that seepage and runoff do not go directly into surface or ground water. Storage areas should be engineered to capture pollutants in melt water. These observations apply basically to water quality within the parks, which is evaluated in the water quality section for each alternative. The State does not express concern about impacts on waters of the

State outside the parks. Given the State's concern regarding the content of plowed, stored snow, and its potential to affect runoff, there is equal concern regarding pollutants from oversnow vehicles in the stored, compacted snow on groomed surfaces. Miles of groomed surfaces are immediately adjacent to surface waters, as reflected in the risk analysis for each alternative under water resources.

Air Quality. The State notes that the proposed snowmobile emission threshold may not be achievable. If it is not, the State also says, the result could be the total elimination of snowmobiles from the parks, as we know them today by 2008-2009. The NPS asserts that this is not a statement of effects on air quality, but rather on the willingness of industry and State to acknowledge there is a problem. The State expresses no concern about air quality impacts in the park because there are no documented violations of State pollution standards. The Park Service's assessment is that the intent of this alternative to improve air quality in the parks would improve air quality in the State.

Wildlife. The State does not expect a "significant" effect on wildlife management east of YNP since population sizes of bison and elk within the park are more of a factor than is accounted for by winter use planning. Both motorized and nonmotorized winter recreation are of concern in the Jackson area. Impacts within GTNP are discussed in the wildlife section for each alternative. The State suggests additional closures be applied. The State also notes that elimination of snowmobiles on Jackson Lake would unjustly limit recreational fishing on the lake. The NPS notes that this action would also eliminate a source of pollution that would go directly into surface water, and that access for fishermen would still be allowed by other means.

Recreation. In its written comments, the State of Wyoming provided an assessment of impacts on snowmobile recreation in the park. The NPS, as the manager for this use in national parks, has performed this assessment and disclosed the consequences under *Visitor Access and Experience* for alternative B, in Chapter IV. No impacts have been identified for State lands in Wyoming, or private lands in Wyoming adjacent to the parks.

Economics. Economic impacts on the State of Wyoming are considered and disclosed in *Economic Effects*, Chapter IV.

Alternative C

Water Quality. Potential impacts expressed by the State are the same as in alternative B.

Air Quality. No impacts were identified by the State, other than a positive effect with the proposed reduction in snowmobile emissions. The NPS assumes that this statement is based on the requirement for the use of bio-based fuels. However, in many respects, alternative C is similar to alternative B, so impacts noted for that alternative by the State also apply to this alternative.

Wildlife. The State does not expect a "significant" effect on wildlife management to the east of YNP since population sizes of bison and elk within the park are more of a factor than is accounted for by winter use planning. The State notes that both motorized and nonmotorized winter recreation are of concern in the Jackson area. Impacts within GTNP are discussed in the *Wildlife* section for each alternative. The State suggests additional closures be applied to areas where nonmotorized activities occur.

Recreation. The State notes that plowing the road from West Yellowstone to Old Faithful will cause a loss of opportunity for overnight stays in West Yellowstone by individual and commercial users from the South, North, and East Entrances. A number of other impacts within the park are disclosed in the *Visitor Access and Experience* section for alternative C. No impacts have been identified for State lands in Wyoming, or private lands in Wyoming adjacent to the parks.

Economics. Economic impacts on the State of Wyoming are considered and disclosed in the *Economic Effects* section of the EIS.

Alternative D

Water Quality. Potential impacts expressed by the State are the same as in alternative B.

Air Quality. Potential impacts expressed by the State are the same as in alternative B.

Wildlife. Potential impacts expressed by the State are the same as in alternative B.

Recreation. The State notes that closure of the East Entrance of YNP would adversely affect motorized recreation opportunities in northwest Wyoming as most of other lands within the snowbelt are designated wilderness and therefore off-limits. NPS use figures indicate that this would affect an average of 36 snowmobiler days, and peak day usage of 64. Not only are many areas unavailable on the Shoshone NF because they are in wilderness, they are also unavailable due to lack of reliable snow and prohibitive terrain. The Custer NF to the north is largely unused by snowmobiles for the same reasons. Other impacts noted by the State are disclosed in *Visitor Access and Experience* sections for alternative D, Chapter IV.

Economics. The State notes that Flagg Ranch would experience a significant negative impact. It also notes that the impact could be minimized or eliminated if the parks and the ranch could work together to convert Flagg Ranch to a destination site. With the Grassy Lake route, this could provide an improved interior experience for snowmobile users and facilitate a potential net gain in revenues. This is the expressed rationale of NPS in proposing such an alternative feature, along with other positive aspects. The NPS agrees that, like the current experience offered at Old Faithful, there is a special experience involved in access to destinations via oversnow means. Other economic impacts on the State of Wyoming are considered and disclosed in *Economic Effects*, Chapter IV.

Alternative E

Water Quality. Potential impacts expressed by the State are the same as in alternative B.

Air Quality. The State notes the likelihood of positive effects on air quality issues through establishment of an advisory committee. The NPS notes that this is a tacit agreement that air quality issues exist, but that they would not be addressed directly. The establishment of such a committee would not directly improve air quality.

Wildlife. Potential impacts expressed by the State are the same as in alternative B.

Recreation. The State notes that closure of the CDST would adversely affect motorized recreation opportunities in the western United States as the vast majority of other lands within the snowbelt is designated as wilderness and therefore off limits. The NPS disagrees with this assessment, as shown elsewhere in this document. The CDST in GTNP is used only marginally, and that is primarily for access into YNP. This opportunity remains, and a shuttle service would be provided to transport CDST users from the GTNP's east boundary to Flagg Ranch. The NPS agrees that the experience would be changed, but the opportunity remains. Other impacts noted by the State are disclosed in V*isitor Access and Experience* for alternative D, Chapter IV.

Economics. Economic impacts on the State of Wyoming are considered and disclosed in *Economic Effects,* Chapter IV.

Alternative F

Water Quality. Potential impacts expressed by the State are the same as in alternative B.

Air Quality. The State notes that there would be a positive effect on air quality by adopting new technology as it becomes available.

Wildlife. Potential impacts expressed by the State are the same as in alternative B.

Recreation. Many of the State's observations about recreation impacts are disclosed in *Visitor Access and Experience* for alternative F, Chapter IV. Other comments by the State follow. Closing the road from West Yellowstone to Old Faithful, Norris to Mammoth, and from Madison to Norris would cause a loss of capacity for overnight stays in West Yellowstone and at Mammoth by individual and commercial users from the South and East Entrances. Eliminating the CDST and Grassy Lake Road would adversely affect motorized recreation opportunity in Wyoming and GTNP, as well as in the western United States. These trails help link independent trail systems to create a unique snowmobile recreation opportunity unequaled west of the Mississippi River. This closure would destroy the connecting link to snowmobile trail systems in the states of Idaho and Montana. See previous alternative: alternatives E and F are the same for GTNP.

Economics. Economic impacts on the State of Wyoming are considered and disclosed in the *Economic Effects* section of the EIS.

Alternative G

Water Quality. Potential impacts expressed by the State are the same as in alternative B. The Park Service's assessment is that the risk of impacts to water quality would be decreased by eliminating a major source of pollution in the parks' snowpacks. See impacts in the *Water Resources* section for this alternative, Chapter IV.

Air Quality. The State notes that there would be a positive effect on air quality by allowing mass transit oversnow vehicles only.

Wildlife. Potential impacts expressed by the State are the same as in alternative B. Because of concerns expressed by the State, as discussed in Chapter III, recommended mitigation has been added into alternative F.

Recreation. The State notes that eliminating the snowmobile experience in the parks will greatly reduce recreation visitation. Also that eliminating the CDST would adversely affect motorized recreation opportunity in Wyoming and GTNP, as well as in the western United States. The results of the winter use survey indicate that nonresident winter visitation to the GYA would decrease by 33.4% in this alternative. Much of this visitation loss would be attributed to snowmobilers who would go elsewhere. The Park Service's assessment is that there would most likely be replacement visitation from a national market of people who would come to the GYA and recreate, partly owing to the new opportunities and experiences offered in the parks in this alternative.

Economics. Economic impacts on the State of Wyoming are considered and disclosed in *Economic Effects*, Chapter IV.

Effects on the State Of Montana

Alternative A

The State of Montana identified no impacts associated with alternative A. However, the State expresses concerns about effects for all alternatives as follows: "Montana Department of Fish, Wildlife and Parks owns important wildlife habitat in the heart of the Gallatin Canyon. These lands lie in a checkerboard arrangement with the Gallatin National Forest. Any of the alternatives that propose closing access to the park from West Yellowstone could lead to impacts on important and sensitive wildlife winter ranges in the Gallatin Canyon. These lands provide important winter habitat for elk, moose, and bison. These lands are primarily situated from the Gallatin Canyon park entrance north to the Porcupine drainage and also includes land in the Taylor Fork. Montana Department of Fish, Wildlife and Park's effectiveness in managing winter recreation is directly influenced by Gallatin National Forest management due to the checkerboard pattern." The NPS assumes that the State means closing access to snowmobiles, because access is provided from West Yellowstone in all alternatives but

alternative F. No impacts have been identified specifically for State lands or private lands in Idaho adjacent to the parks.

The NPS determines that there would be no significant impacts on other State or private lands. This is based on the best available information from the winter use survey about how overall use from nonresident visitors to the GYA would either remain the same or would decline through the range of alternatives. Any State or private land near winter uses would have the same or less pressure.

Alternative B

The State notes that under alternative B plowing the road from West Yellowstone to Old Faithful would be disruptive to West Yellowstone's local economy and established visitor service system. Based on field experience and trails program administration, the State foresees a scenario where the level of visitation in the West Yellowstone area by the snowmobiling public will remain level or increase regardless of whether alternative B is implemented. According to the State, several areas exist in which significant negative impacts are expected to occur outside the park as a result of implementing alternative B.[83]

Wildlife. The State notes that snowmobilers would likely be diverted to national forest lands surrounding the YNP and West Yellowstone. The State is concerned that elk winter range in the Hebgen and Taylor Fork areas, which have seen little or no use, would be significantly impacted if large numbers of snowmobilers were diverted away from the park and onto the adjacent national forest lands. These winter ranges are important to maintaining Montana's elk populations, and are more sensitive compared to the groomed road from West Yellowstone to Old Faithful. The Park Service's estimate of displaced use is given at the beginning of this section.

In this context the best information available indicates that use in the GYA would decline by 18.4% thus relieving pressures on adjacent lands. If this scenario occurs, there could be an economic impact as the State suggests (assuming no replacement visitation). However, if snowmobilers stay in West Yellowstone and use adjacent lands creating an inordinate impact on wildlife, then there would be no economic effect. The two hypotheses are not consistent.

The State indicates that the area north of Hebgen Lake, known as the "Hebgen Face" near Kirkwood and Red Canyon, is designated winter range and has a resident elk population through the winter. In the past this area has experienced little conflict between wildlife and snowmobilers. The concerns expressed above may exacerbate impacts to elk on this winter range. Also the State feels that a potential result would be a flood of snowmobile travel north through Cabin Creek to Carrot Basin and into the Taylor Fork drainage. Several outfitted and private snowmobile groups may try to travel through the Taylor Fork winter range to connect with the Buck Ridge area and then on into Big Sky. Last,

[83] All the following listed impacts are expressed by the State of Montana using an assumption of total displaced use from the parks to adjacent lands. See the use displacement scenarios at the beginning of this section.

according to the State, any substantial increases in the number of snowmobilers trying to reach Big Sky from Wapiti Y, (Taylor Fork drainage) by any number of routes, may significantly impact bear denning sites. Cache Creek, Beaver Creek, and the Yellow Mules have known grizzly bear denning sites.

The State notes that during this period, use of the roads by bison increases, and bison more readily move longer distances and could exit the park more easily than on groomed snowmobile trails. They believe there would be a tunnel effect created by winter plowing, encouraging bison movement out of the park and complicating bison management in West Yellowstone and Horse Butte. The State recommends including mitigation provisions for the plowing option, such as clearing exit lanes at key trail break off points for bison and elk, or modifying snow removal methods to eliminate an accumulation of snow along side the road system. The Park Service's analysis (See the analysis of impacts on bison and ungulates for alternative B) indicates that bison make little use of groomed surfaces by bison to exit the park, and such mitigation is already included.

The State is concerned about the potential for any substantial and unexpected increase in snowmobile use north of the park boundary. Travel management concerns in the Gallatin Canyon would become a major focus for the State and the Gallatin NF. The State says that riding from West Yellowstone to the Taylor Fork drainage, many snowmobilers want to continue their travel onto Big Sky. Also snowmobilers choose to travel out of the Taylor Fork drainage using the plowed access road to Highway 191. The use of the maintained road is illegal under Montana statute. Using the barrow pit along Highway 191, snowmobilers travel north, and at times travel on the pavement of the highway, to Buck Ridge trailhead. From this point they can easily access the Big Sky area for services such as gas, food, and lodging. Snowmobiles also travel the return route, resulting in several recent near-miss accidents. As regrettable as these circumstances are, they appear to be outside the jurisdiction of the park, and would continue apart from any future management change (alternative) that the park may implement.

Alternative C

The State offers the same comments as in B regarding the plowed section of road.

Alternatives D and E

The State offers no impact analysis for these two alternatives.

Alternative F

The State reiterates comments from alternative B regarding their suggestions to mitigate air quality impacts at the West Entrance. See also the discussion under alternative A.

Alternative G

The State notes that this alternative would place additional stress on "some of the most sensitive natural resource areas north of the park," which currently receive high and increasing amounts winter snowmobile recreation activities. The NPS notes that there

are no specific statements of impact supporting this conclusion. Assuming the State is referring to lands on the Gallatin NF, the reader is referred to the earlier section regarding impacts on national forest lands. Regarding State lands, refer back to *Effects on the State of Montana* in this section.

Effects on the State of Idaho

No impacts have been identified specifically for State lands or private lands in Idaho adjacent to the parks. The NPS determines that there would be no significant impacts on these lands, based on the best available information about how overall use from nonresident visitors to the GYA would either remain the same or decline through the range of alternatives. Any State or private land that lie in close proximity of winter uses would similarly have the same or less pressure.

Alternative A

The State presents no impacts associated with current management.

Alternatives B through G

The State notes it is likely that a plowed road in alternatives B and C from West Yellowstone to Old Faithful will result in additional pressure on snowmobile trail opportunities in Idaho. Presently the Fremont County snowmobile trail system only has three snowmobile trail groomers to maintain 400 miles of trail. An additional influx of snowmobiles from West Yellowstone would place more wear on existing Fremont County snowmobile trails. The State says that some of these trails are already at their maximum level of use, and are groomed once weekly.

The State indicates that alternative G would displace 100% of the snowmobile visitors to the parks who would either recreate on adjacent lands or not come to the GYA. The State says that eliminating access to Flagg Ranch would disconnect visitors from the CDST in Wyoming and 20 miles of trail that represent a unique experience. Also they indicate that this lack of access eliminates groomed snowmobile access to Cave Falls, and that snowmobilers would still use this route, which is within two miles of the park boundary. The State's opinion is that alternative G has irreversible and irretrievable consequences, including loss of personal freedom for winter visitors, loss of opportunity for visitors who cannot ski or snowshoe, loss of opportunity to view YNP by snowmobile, and loss of Idaho's version of the Grand Loop experience. In addition the State feels that the elimination of snowmobiling would cause increased safety problems outside the parks from congestion and trail deterioration.

In this context the best information available indicates that use in the GYA would decline by 18.4% in alternative B and 33.4% in alternative G, thus relieving pressures on adjacent lands. If either scenario occurs, there could be an economic impact as the State suggests (assuming no replacement visitation). However, if snowmobilers stay in West Yellowstone or in Idaho and use adjacent lands, creating additional safety problems as stated, then there would be no economic effect. The two hypotheses are not consistent.

Effects on Teton County, Wyoming

The NPS determined that there would be no significant impacts on lands within the jurisdiction of Teton County. This is based on the best available information from the winter use survey about how overall use from nonresident visitors to the GYA would either remain the same or would decline through the range of alternatives. Any state or private land near winter uses would have the same or less pressure.

Alternative A

According to the County, there would be no significant recreation or economic impacts.

Alternative B

The County states that there is the potential for a significant increase in visitation to YNP through the South Entrance as a result of eliminating oversnow access from West Yellowstone. Their opinion is that this could result in an increase of rental sleds both in Jackson as well as at Flagg Ranch. The County also thinks it likely that the amount of commercial guiding originating in Teton County would increase. The County did not estimate the dollar amount of impact, not knowing potential visitation numbers, infrastructure constraints, or commercial permit restrictions.

The County's opinion is that eliminating snowmachines on the Teton Park inside road should not have a significant economic impact to Teton County because the area is mostly used locally, and states it could have an economic benefit to Teton County by drawing more skiers to the area.

Teton County believes that relocating the CDST to a year-round pathway should provide economic benefits to Teton County by drawing more users to the area. In addition it recommends opening the trail to commercial use to provide additional economic benefit to the county.

Alternative C

The County states that relocating the CDST to a utility corridor from Moran to Flagg should greatly improve both the safety of the trail as well as recreational experience for snowmobilers in GTNP. Further, if the trail were open to commercial users it could draw significantly more users and benefit the county economically.

The County indicates the potential for a significant increase in visitation to YNP through the South Entrance as a result of eliminating oversnow access from West Yellowstone. The County states that this would result in an increase of rental sleds both in Jackson as well as at Flagg Ranch, and an increase in the amount of commercial guiding originating in Teton County.

Alternative D

The county states that relocating the CDST to the utility corridor from Moran to Flagg would greatly improve trail safety and recreational experience for snowmobilers in GTNP. It recommends opening the trail to commercial use to provide additional economic benefit to Teton County.

The County believes that closing the road north of Colter Bay to wheeled-vehicles and opening it to snowmobiles could have adverse and beneficial impacts. By eliminating the ability to stage commercial and individual snowmobile trips from Flagg Ranch, the trip to Old Faithful may be too long for most users for a day trip. This could significantly reduce both the number and ability of visitors from Teton County to experience YNP via snowmobile in one day. Conversely, according to the County, closing this section of road would provide an improved snowmobile experience in GTNP. They state that if commercial guides were permitted to stage trips out of Colter Bay, use within GTNP could rise dramatically.

The county's opinion is that eliminating snowmobiles on the Teton Park Road should not have a significant economic impact to Teton County because the area is mostly used locally. The County states it could have an economic benefit to Teton County by drawing more skiers to the area.

Teton County states that relocating the CDST to a utility corridor would provide economic benefits to Teton County by drawing more users to the area, and that opening the trail to commercial use would provide additional economic benefit to the county.

The County states that closing the road north of Colter Bay to motor vehicles could have significant negative economic impacts to Teton County. It indicates that Flagg Ranch currently rents over 5,000 snowmobiles per year to visitors who enter YNP. If the road were closed, visitors would either need to rent their sleds at Colter Bay or be shuttled to Flagg Ranch via snowcoach. In addition 12 concessioners offer guided snowmobile tours into YNP via the South Entrance. According to the county, the trip to Old Faithful may be too long to stage from Colter Bay and could result in a loss of about $671,000. The county suggests that if the concessioners were allowed to stage out of Colter Bay, visitors could experience GTNP and perhaps YNP, and concessioners would recoup most of those costs.

Alternative E

The County's opinion is that eliminating snowmachines on the Teton Park inside road would not have a significant economic impact to Teton County because the area is mostly used locally. The County states it could have an economic benefit to Teton County by drawing more skiers to the area.

The County's opinion is that eliminating all motorized vehicles on Jackson Lake and closing the CDST could cause impacts to Teton County. They State that without the trail, the only local opportunity to snowmobile in a national park would be a trip into YNP.

Alternative F

The County's observations on recreation impacts are the same as in alternative C.

The County states that eliminating access from West Yellowstone and Mammoth could results in a significant increase in visitation to YNP through the South Entrance. Further, it believes this could result in an increase of rental sleds both in Jackson as well as at Flagg Ranch, and that commercial guiding originating in Teton County likely would increase.

Alternative G

The County's opinion is that eliminating snowmachines on the Teton Park inside road would not have a significant economic impact to Teton County because the area is mostly used locally. The County states it could have an economic benefit to Teton County by drawing more skiers to the area.

The County's opinion is that eliminating all motorized vehicles on Jackson Lake and closing the CDST could cause impacts to Teton County. They State that without the trail, the only local opportunity to snowmobile in a National Park would be a trip into YNP.

The County suggests that this alternative lacks opportunities for groomed trail nordic skiing. The County states that there is a lack of public recreation opportunities and that the NPS is ignoring this need.

Closing the road north of Colter Bay to wheeled-vehicles and opening it to mass transit oversnow vehicles could have both significant adverse as well as beneficial impacts, according to the county. It states that by eliminating the ability to stage commercial and individual snowmachine trips from Flagg Ranch, this would eliminate the ability of visitors from Teton County to experience YNP via snowmobile. Current commercial outfitters as well as Flagg Ranch would be impacted significantly. The county also believes that, conversely, providing oversnow mass transit may draw new visitors to Teton County that prefer this type of recreation and atmosphere and create economic benefit.

Effects on Gallatin County, Montana

Gallatin County indicated that its survey of businesses in the County would be used to determine overall economic impacts. The County offers no specific assessments of impacts for each alternative. Economic impacts on the County are considered and addressed in the socioeconomic effects section of this document. The NPS determines that there would be no significant impacts on lands within county jurisdiction, based on the best available information about how overall use from nonresident visitors to the GYA would either remain the same or decline through the range of alternatives. Any State or private land near winter uses would have the same or less pressure.

Effects on Park County, Montana

Input from this cooperating agency does not provide an assessment, by alternative, of socioeconomic impacts. It notes that alternative B would have a devastating effect on the economy of West Yellowstone, which is not located in Park County. Park County indicates that it does not have a booming economy and that wages and employment have declined. The results of a survey conducted with businesses in Park County have been reviewed. Related economic impacts are considered and addressed in the socioeconomic effects section of this document. From the results supplied with Park County's comments on the DEIS, it would appear that important conclusions are difficult to ascertain. The survey is predicated on either the closure of the park (which is not an alternative) or closure to snowmobiles (alternative G). The listing of results does not allow determination of whether the winter visitors in question are snowmobilers or people who ski or travel by snowcoach. For example, the results list lost sales if YNP "winter visitors" were prohibited – this presumes closure of the park. Also it is difficult to determine, from the questions asked about winter business closures, which of the businesses would close during the winter whether or not park management could change.

The NPS determined that there would be no significant impacts on lands within county jurisdiction, based on the best available information about how overall use from nonresident visitors to the GYA would either remain the same or decline through the range of alternatives. Any state or private land near winter uses would have the same or less pressure.

Effects on Fremont County, Idaho

Information provided by this cooperating agency includes a report on the economic importance of the winter season to the County. It states that the county provides a variety of winter recreation opportunities, and that it provides a connector for important winter destination areas including the parks, West Yellowstone, and Flagg Ranch. The County's winter population increases due to annual snowmobiler days of 300,000, and 40,000 days attributed to other recreation users. As background, the county notes that pressure on the local trail system (400 miles of groomed trail) and related facilities increases when YNP closes for the season. It experiences 1,200 more snowmobilers per weekend following the closure. Specific to alternative G, which closes the Grassy Lake Road to snowmobile use, the county believes that without groomer access to fuel at Flagg Ranch, it would be unable to groom two high-use trails of about 67 miles. Similarly, snowmobiles would not have access to fuel in trail experiences. The County also states that some opportunities near, or perhaps on, the park from the Idaho side would continue to be used by snowmobilers, and this would necessitate additional enforcement effort by the NPS.

Leaving the Grassy Lake Road open for snowcoach use mitigates the county's concerns to some degree. The need for grooming the road surface remains. This would facilitate the grooming of trails on adjacent lands.

The NPS determined that there would be no significant impacts on lands within county jurisdiction, based on the best available information about how overall use from nonresident visitors to the GYA would either remain the same or would decline through the range of alternatives. Any state or private land near winter uses would have the same or less pressure.

Effects on Park County, Wyoming

This cooperating agency did not identify specific impacts, by alternative, on the County or private lands within it. The NPS determined that there would be no significant impacts on lands within the County jurisdiction, based on the best available information about how overall use from nonresident visitors to the GYA would either remain the same or decline through the range of alternatives. Any state or private land near winter uses would have the same or less pressure.

Cumulative Effects on Adjacent Lands

Effects analysis on adjacent lands, as constituted in this EIS, is inherently a cumulative impacts analysis. Cumulative impacts are defined as the effects of the proposed action, added to the past, present, and reasonably foreseeable impacts in the area of concern. The determination of cumulative impacts is required in an EIS, but the potential for cumulative impacts is not a CEQ regulated constraint on the eventual decision. In other words, impacts may be incurred by virtue of a decision as long as they are not in violation of a law, and if they are disclosed properly, considered, and mitigated (if possible).

Framework for Analysis

This analysis is conducted by identifying the area of concern for a resource, determining all impact sources on the resource within the area, and then assessing the additive impact of the proposed action on that resource and the total cumulative impact. The frame of reference for this analysis is as follows:

1. Since the major source of impact would be potential displacement of snowmobile use from national parks to national forests in the GYA, the context for the issue is how use might change in the GYA. The primary change would be in relation to numbers of visitors from outside the GYA, and how they would react to alternatives that affect snowmobile access to the parks. Use and access by residents could be locally redistributed; as it may affect total use in the GYA, it could only decrease as a result of the alternative changes. The NPS assumes it would remain within the GYA; that is, local users would continue to use the GYA as at present. They could go to other GYA areas, described as “local redistribution” in this analysis.
2. Existing forms of recreation access and opportunity in the parks could directly affect alternatives and alternative features.
3. Some of the people who may be affected by alternatives or alternative features might be displaced to adjacent lands. These are indirect or secondary effects, which are removed in time or space from the source of impact.
4. Some of the use that is displaced to adjacent lands could cause further impacts on those lands or their resources. These are secondary or tertiary effects, which are removed in time or space.

5. The additional use on adjacent lands is added to the existing use on those lands, concurrent with increasing use from other sources. This is the total cumulative impact.

Areas and Resources of Concern

In this analysis the State of Montana and the national forests have expressed concerns about potential impacts of various alternatives on resources in those jurisdictions. Wyoming and Idaho have not directly expressed such concerns, although both allude to changes in recreation within those states. The resources of concern include recreational opportunity and experience (including associated facilities: trails and trailheads); and wildlife (including threatened and endangered species). The area of concern is that which is subject to potential displaced snowmobile use; this is the entire GYA area outside the parks that is capable, suitable, and available each year to support seasonal snowmobile use. This area is defined and mapped in the GYCC Multi-Agency Winter Visitor Use Assessment (1999).

Source of Impact from the Proposed Action

The source of impact for all concerns expressed by cooperating agencies is the displacement of winter recreation use, primarily snowmobiles, associated with identifiable features in the range of alternatives. These are: plowing the road from West Yellowstone to Old Faithful (alternatives B and C); closing the North and West Entrances (alternative F); closing the East Entrance (alternative D); removing the CDST (alternatives E and F); and closing all park units to snowmobiles (alternative G). The USFS expressed concern about backcountry closures in YNP in alternative F, and removing skiing opportunities from Colter Bay to Flagg Ranch (alternatives D and G). Alternative-specific scenarios of displacement were developed and supplied to the USFS at its request. The NPS used information available in the DEIS and the winter visitor survey to assess generally how many people (in different user groups) would continue to visit the GYA relative to various park management changes.

The scenarios used by NPS are displayed at the beginning of the section entitled *Direct, Indirect, and Cumulative Effects on Adjacent Lands* and in Appendix G. They are dependent on the winter visitor survey results developed by Duffield and Neher (2000a) for this EIS. In short, use of the best available information about what current winter visitors would do shows that overall visitation in the GYA by nonresidents (80% of the visitation) could decrease substantially in alternatives B, C, F, and G. Visitation would remain the same in A and E, but decline slightly in D. Visitation to the GYA affects both national parks and national forests.

Past, Present, and Reasonably Foreseeable Impact Sources in the Areas of Concern

Montana, Idaho (Fremont County), and the USFS all were concerned about use (primarily snowmobiles) being displaced from the park units and added to the use that

already exists in their jurisdictions.[84] General statements are provided by those cooperating agencies about current use at a threshold, crowding and demand on facilities and popular areas, safety, displacement of nonmotorized users, and important winter habitat for a variety of ungulate species. Other issues relating to the indirect, secondary, and tertiary effects of use displaced from the parks includes denning grizzly bears, spring bear emergence, nesting bald eagles, and lynx habitat.

All such concerns for national forests were expressed as conflicts and mapped in the multi-agency assessment for winter visitor use in the GYA. A summary of these concerns is found under alternative A in the section entitled *Direct, Indirect, and Cumulative Effects on Adjacant Lands* and in Appendix G. A statement of concern from Montana may be found under alternative A in the section on Montana. Effects on Fremont County, Idaho, above, speak to current pressures on its trail system. For cumulative effects analysis, regarding these adjacent lands, it appears that either the current level of impact is high or concern exists about greater use in areas of currently low density use. All these entities also state that the foreseeable impacts due to winter use on their lands will increase, because of the present rate of growth in the sport. The Targhee NF notes an annual 4% to 5% increase. Therefore, the environmental baseline for assessing cumulative impacts on adjacent lands must account for: current high level of impacts and conflicts in some areas, with increasing trends in use.

Total Cumulative Impact

Management changes in the three park units could result in local redistribution of use which, added to current use and demand, could cumulatively impact resources or values on adjacent lands (given the characterizations of current condition by the USFS, Montana, and Fremont County, Idaho). These impacts might include: further stress on facilities and infrastructure, habitats, and deteriorating recreation experiences and opportunities in some areas outside the parks.

- For the USFS, identified areas of high use conflict[85] would presumably increase in magnitude, extent, and duration (Island Park, Gallatin Canyon, Togwotee Pass, Beartooth Plateau, Cooke City, et al.). Conflict areas identified as being low or moderate in intensity could become worse. Additional areas not previously identified as being of concern could arise.
- For Montana, winter ungulate habitat in Gallatin Canyon could be further impacted, with resultant stress on individual animals and overall negative impacts on populations.
- For Idaho, the Fremont County trail system would experience further demand and crowding resulting in a decline in visitor experience and increased grooming expense.
- In all areas motorized use would tend to affect desired experiences of nonmotorized users and displace that use from ever-decreasing areas of opportunity.

[84] In contrast, the State of Wyoming expressed no such concerns. Its overriding assumption in all economic and recreation analyses is that the snowmobiles will no longer come to the GYA in most management change scenarios.
[85] See assessment of alternative A for Effects on National Forest Lands, and the Winter Visitor Use Management Assessment as cited therein.

The NPS assessment of total cumulative impact on adjacent lands in the GYA includes the following considerations.

- The major source of impact is potential displacement of snowmobile use from national parks to national forests in the GYA. The context for this issue is how use might change overall in the GYA. The primary change would be in relation to visitors from outside the GYA and how they would react to alternatives that affect snowmobile access to the parks. As documented throughout this section. This visitation would be expected to decline substantially in alternatives B, C, F, and G. It would remain the same or decline slightly in A, D, and E.
- Use and access by residents could be locally redistributed, but it is generally accounted for within the current condition. The NPS assumes it would remain within the GYA; that is, local users would continue to use the GYA in the same amount as at present but they could go to other areas (described as "local redistribution" in this analysis). Local redistribution scenarios are hypothesized at the beginning of the *Direct, Indirect, and Cumulative Effects on Adjacent Lands* section.[86] In alternatives B, C, F, and G, the total decline in visitation to the GYA would more than offset any local redistribution increases – unless resident use comprises most of the current total use.
- The USFS in its assessment of winter use identified management actions that could be taken to relieve conflict areas on national forest lands. Some forests identified unused or minimally used lands, which could be made more accessible by developing parking or trailhead facilities. There may be unused capacity on forests to absorb local redistribution.
- In the context of cumulative effects, the proposed action may not be, and arguably should not be, the only focus of mitigation or change in management. National forests are governed by forest plans and other constraining rules, regulations and agreements that prescribe or specify management actions in relation to resource conditions or, for example, habitat needs. The USFS indicates that not all plans directly or consistently address species requirements or changed conditions (winter use, newly listed species). However, plans, strategies, and guidelines must be followed for lynx, bears, wolves, eagles, or other currently listed species for each forest.
- NEPA (CEQ Regulations) does not require that an EIS discuss remote and conjectural consequences, and that decisions need not be made on the basis of possible, but speculative, effects.[87]
- An EIS is adequate if it provides discussion of direct and secondary impacts and conflicting scientific judgments regarding cumulative effects.[88]

Alternative A

Cumulative impacts have been ascertained, considering existing and reasonably foreseeable direct and indirect effects on adjacent lands to the degree necessary. Environmental effects that are easily identified are disclosed in detail, and effects that cannot readily be ascertained are nonetheless discussed sufficiently.[89] This alternative would not displace additional use from the parks to adjacent lands, while impacts of current use would continue on adjacent lands at the present level.

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[86] Forest Service views a worst-case scenario to be appropriate, where worst-case represents displacement of all current users in the parks to adjacent lands. For reasons presented at the beginning of the adjacent lands section, NPS believes the best available information is presented through the survey of current visitors and that a worst-case scenario remains subject to too many assumptions. FS' worst-case is refuted by the visitor survey.

[87] *Sierra Club v. Hodel*, 544 F.2d 1036, 1039 (9th Cir. 1976), et al.

[88] *Environmental Defense Fund, Inc. v. Hoffman*, 566 F.2d 1060 (8th Cir. 1977), et al.

[89] *Citizens for Environmental Quality v. U.S.*, 731 F.Supp. 970, 995 (D. Colo 1989) held that for effects not readily ascertained, detailed discussion is not contemplated under NEPA.

Alternative B

By virtue of the closure of YNP's West Entrance to snowmobiles, local use could be redistributed to adjacent lands, along with a percentage of nonresident visitors who state they would return to the GYA in the circumstances posed by alternative B. The NPS estimates this amount to be about 6,700 snowmobiler trips over the season, or 75 snowmobile trips daily. The overall cumulative impact would be a decrease in use on adjacent lands because of an 18.4% reduction in nonresident visitation to the GYA. The 75 trip redistribution per day, divided between adjacent lands on the west side of YNP (where 300,000 snowmobiler days are currently experienced) would be negligible. Users displaced from the Teton Park Road and the surface of Jackson Lake average 45 to 50 snowmobiler trips per day, who would either enter YNP or go elsewhere on the Targhee, Shoshone, or Bridger-Teton National Forests. Some displaced users would enter the parks at other gateways and not impact adjacent lands. The level of congestion and conflicts currently identified on the west side of YNP could improve due to lower use by nonresident snowmobilers.

Alternative C

Total cumulative impact would be the same as that described in alternative B. The late season plowing of the Mammoth to Madison road segment could further displace local use by 1,700 visitor trips during February and March to adjacent lands near Gardiner and Cooke City. Again, this could be offset by a total nonresident reduction in use in the GYA of 18.4% in terms of total cumulative impact.

Alternative D

By virtue of closing YNP's East Entrance to snowmobiles, use that could be displaced to elsewhere in the GYA amounts to about 3,300 snowmobiler visits over the season, or an average of 40 snowmobiler trips per day that could go to other gateways or to national forest lands. Users displaced from the Teton Park Road and the surface of Jackson Lake, which amounts to an average of 45 to 50 snowmobile trips per day combined, would either enter YNP or go elsewhere on the Targhee, southern Shoshone, or Bridger Teton National Forests. By virtue of a 4.4% reduction in total visitation by non-GYA residents, the total cumulative impact on adjacent lands would decline slightly. Due to local redistribution and uncertainty in use numbers, the overall cumulative impact in the GYA would be indistinguishable from the current condition.

Alternative E

This alternative would not reduce visitation by nonresidents. Local use in GTNP would be displaced by the closure of the Teton Park Road and the CDST segment within the park. Use on the CDST is almost exclusively destined for YNP, most of it being staged from Flagg Ranch. In alternative E, this opportunity remains available, so this amount of use would likely not be displaced to adjacent lands. Users displaced from the Teton Park Road and the surface of Jackson Lake, which amounts to an average of 45 to 50 snowmobile trips per day combined, would either enter YNP or go elsewhere on the Targhee, southern Shoshone or Bridger-Teton National Forests. As a percent of use on

the latter two forests, this would not appear to be significant. The overall cumulative impact in the GYA would be indistinguishable from the current condition.

Alternative F

By virtue of closing YNP's West and North Entrances, local use could be redistributed to adjacent lands, along with a percentage of nonresident visitors who state they would return to the GYA in this use scenario. The NPS estimates this amount to be about 4,000 snowmobiler trips over the season; or 50 snowmobile trips daily. The overall cumulative impact would be a decrease in use on adjacent lands because of a 24.6% reduction in nonresident visitation to the GYA. The 50 trip redistribution per day, divided between adjacent lands on the west and north sides of YNP would be negligible. Users displaced from the Teton Park Road and the surface of Jackson Lake would amount to an average of 45 to 50 snowmobile trips per day, either entering YNP or going elsewhere on the Targhee, Shoshone, or Bridger Teton National Forests. Some local displaced use would enter the parks at other gateways and not impact adjacent lands. The level of congestion and conflicts currently identified on all adjacent lands could improve due to lower use by nonresident snowmobilers.

The NPS has estimated that the closure of YNP to backcountry nonmotorized use could displace 844 skiers per year. Based on the winter use survey results, about 5% of these users would or may continue to visit the GYA to engage in this use. In this alternative using the survey assumptions, an estimated 42 skiers annually would be displaced to surrounding national forests or to GTNP. This would not appear to represent a significant impact on adjacent national forests.

Alternative G

By virtue of closing the three park units to snowmobiles, total visitation to the GYA by those who live outside the five-county area would be reduced by 33.4%. Local use could be redistributed to adjacent lands, along with a percentage of nonresident visitors who state they would return to the GYA in this use scenario. The NPS estimates this amount to be about 5,230 snowmobile trips over the season, 65 snowmobile trips daily. This level of redistribution would appear to be easily absorbed in the total use for all national forests in the GYA. The overall cumulative impact would be a decrease in use on adjacent lands because of a 33.4% reduction in nonresident visitation to the GYA (which is 80% of the current winter visitation). This reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same, but shift their use to other areas of the GYA (e.g., from the parks to the national forests).

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

In the context of the proposed action, short-term local uses would be those actions that could be implemented under the alternatives for programmatic park plans. The EIS planning effort addresses and discloses effects of alternative strategies for long-term management. The plan to be arrived at in the Record of Decision will set goals and objectives for management based on the alternatives evaluated in the EIS. Technically, no site-specific activities are approved through this process (*Decision to be Made*) and other discussions of programmatic planning in Chapter I). They would require additional environmental analysis before implementation.

All the activities implied in the EIS alternatives could be considered local and short term, in that they are specific to the three park units and are reversible actions. Long-term productivity is construed as the continued existence of the natural resources of the parks, at a sustainable and high level of quality, so that they can retain their inherent value and be enjoyed by the public. Depending on the magnitude, extent, and duration of impacts caused by short-term uses, long-term productivity could be affected.

The analysis in this DEIS has shown few impacts from possible short-term uses that would affect long-term productivity as defined. It is the function of monitoring and mitigation, incorporated into park management, to ensure no such impacts result from implementation. Adaptive management is a dominant theme in two alternatives (alternatives B and E). Adaptive management addressed this relationship (monitoring and management) directly and programmatically. Otherwise every alternative would induce short-term effects on a variety of experiential values or resources that would persist for as long as the impacting activity is undertaken. Programmatic changes in opportunities affecting visitor experience and use (the “enjoyment” part of the mission) would continue for the duration of plan implementation.

Four areas of potential long-term impacts are identified in the analysis.

- Continued management with unregulated backcountry use in GTNP could, without mitigation, further the decline of the bighorn sheep population in the park in conjunction with other impacts.
- The cumulative effect of all park recreational uses on geothermal features could, without mitigation, cause a long-term decline in this resource.
- The cumulative effect of all park recreational use could, without mitigation, affect listed threatened and endangered species or species of special concern.
- The cumulative effect of air pollutants, including continued emissions from 2-stroke engines stored in winter snowpacks, could be routed into aquatic systems and stored biologically or physically. Over time this would represent a change in intrinsic natural park values associated with those systems. The possible extent of such a change, or the amount of indirect impact relative to any existing standard, cannot be determined at this time.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods. It also could apply to the loss of an experience as an indirect effect of a "permanent" change in the nature or character of the land.

An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production foregone is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production. An example of such a commitment would be the loss of cross-country skiing opportunities consequent to a decision allocating an area to snowmobile use only. Should the decision be changed, skiing experiences, though lost in the interim, would be available again.

From an economic or social perspective, there would be no irreversible commitment of resources from any of the alternative actions. However, alternatives to the current management situation that change recreational opportunities or affect visitors by displacing them from accustomed usage, would involve irretrievable losses. By the nature of alternative actions, those losses would be balanced by a gain in some other opportunity or resource benefit. Any perceived losses or tradeoffs in recreational opportunities would have both social and economic consequences that would be irretrievable, but not irreversible.

For example, the plowing of the road from West Yellowstone to Old Faithful in alternative B would cause an irretrievable but not irreversible loss of snowmobiling and snowcoach experiences along that section of road. Secondary effects of this decision could be the irretrievable loss of income to businesses in West Yellowstone dependent on these uses. The loss would not be irreversible because new business opportunities could be available in providing for the alternative modes of access to Old Faithful by bus and shuttle.

By virtue of the alternative actions, which are fully within the protective orientation of the national park mission, and the analysis of effects from them, there would be no irretrievable commitments of any resources. No environmental consequences have been determined that involve the permanent loss of a resource or jeopardy to the existence of any species on the basis of the proposed actions alone. Were it indicated that the presence of existing or proposed levels of snowmobile trail use could cause grizzly bear mortality, then there would be a risk of irreversible and irretrievable commitment of resources. As stated, no such impacts were determined in this analysis.

The proposed action and alternatives prescribe changes from the existing condition for different mixes of winter visitor experience. The changes are intended to address the purpose and need for action described in Chapter I, while sharply defining the public's issues about the proposal. In some alternatives, the consequences of those changes

improve the quality or condition of the parks' experiential values and resources. This includes improving values like air quality, sound versus natural quiet, wildlife species and habitat, and recreation experiences (motorized and nonmotorized) whose quality is dependent on those values. The achievement of such improvements is accompanied by some tradeoff in another aspect of winter recreation such as loss of access (motorized and nonmotorized), altering available modes of transport, redistribution of use, or regulating types of equipment allowed. All these changes or tradeoffs would be associated with an irretrievable loss of the kind indicated. Conversely, for alternatives that optimize access and provide a full range of winter recreation activities, there would be tradeoffs representing irretrievable losses in types and qualities of other visitor experiences. For the range of alternatives a variety of irretrievable resource commitments would be made, but none would be irreversible.

UNAVOIDABLE ADVERSE IMPACTS

The reader is referred to the previous two summary discussions. It should be clear from these discussions that every alternative, including continuation of the current management plan, would result in some impacts. Impacts for alternatives disclosed in Chapter IV range from major adverse to major beneficial relative to alternative A. Impacts are discussed for human health and safety, the economic and social environment, physical and biological resources, and the experiential environment of the three parks. These elements are interrelated and interdependent, as is the nature of any ecosystem process and the human role in it. Therefore, the alternatives taken together display consequences, tradeoffs, benefits, impacts, and opportunity costs in a way that reveals the interdependent working of human and natural park systems.

This means that, considering the human use and enjoyment function (i.e., recreation), an adverse impact from one perspective is often a benefit from another. Therefore, this discussion dismisses further consideration of visitor experience and social concerns, recognizing that there would be unavoidable adverse impacts (from minor to major) across the range of alternatives and the associated range of human perceptions.

Potential unavoidable adverse economic impacts on the regional economy are readily discussed for several alternatives, especially due to the local loss of motorized, oversnow opportunities in the parks. None of these impacts could be considered irreversible or long term in the context of the total economy. For some individual businesses, the effects may be more drastic. It is, however, in the nature of business to start or change course based on economic self-interest and survival. Long-term economic impacts are not easy to determine because of this dynamic, and because the business world is adaptable and creative. So, as indicated in the analysis, it is possible that the negative regional impacts of some alternatives could be offset by a change in the type and mix of visitors coming to the parks.

Potential unavoidable adverse impacts on physical and biological resources are disclosed throughout the range of alternatives. These include impacts on air quality, wildlife

displacement and habituation, water resources, and natural quiet. For the most part, any such impacts are short term (for the duration of the impact cause) and minor. Other possible minor to moderate impacts would be mitigated or avoided by the features of the alternatives or the recommended mitigation measures expressed in specific analyses.

Current impacts on human health and safety represent a major part of the purpose and need for action. Considering the existing condition described in Chapter III, most alternatives represent an attempt to improve factors relating to health and safety. The focus on health and safety is three-pronged: air quality and emissions from snowmachines; motor vehicle accidents and behavior of various recreating user groups; and inherent risks of winter recreation (avalanches). The desired impact is beneficial in reducing these factors. Allowing the range of winter recreational use and access, which is implicit in the purpose and need, carries with it unavoidable potential for accidents.

Unavoidable impacts are referred to in the beginning of *Effects Common to all Alternatives*, Chapter IV. These result from winter use of the parks at any level, and they include impacts on: natural soundscape; wildlife (collisions, displacement); safety; and visitor experience.

CUMULATIVE IMPACTS ANALYSES

Assumptions and Methodology

The alternative programs or plans describe actions that are either larger in scale addressing programmatic direction, or they are represented as examples of activities that could occur. Generally, before such actions could be implemented, further site-specific environmental analysis would be necessary. Therefore, this DEIS evaluates cumulative impacts in the context of programmatic actions proposed in the alternatives, and definitive cumulative impact analysis would be conducted later when site-specific proposals are made and site-specific effects are determined.

Cumulative impacts analysis considers the degree to which any direct or indirect effects from proposed actions adds to or detracts from the possible effects of other past, present, or reasonably foreseeable actions. Since effects of actions are specific to each resource, the types of actions and overall nature of impacts considered in this analysis are disclosed by resource. Each resource is associated with a specific area of concern, and with impact sources that could affect the resource within that area. If an action or an alternative could have a direct or indirect effect on the resource, then this effect is considered additively with the effects of other impact sources. Conversely, if an action does not have a direct or indirect effect on a resource, no additive cumulative effect exists.

The *Cumulative Impact* section for each resource expresses the magnitude of the additive impact of any direct or indirect effects for an alternative, if any, relative to the total impact in the area of concern. Programmatically, the alternatives share the same mix of activities, but to greater or lesser degrees. Therefore, the alternatives do not vary greatly

in terms of general cumulative impacts. Where variations do occur between alternatives, they are noted.

Geothermal Features

Area of Concern. The area of concern includes all geothermal features within the boundaries of YNP. It does not include GTNP or the Parkway.

Potential Impact Sources. The nature of the concern is surface damage to geothermal features. Surface damage can occur from trampling by wildlife and by pedestrian visitor use in the summer. Acts of vandalism that add litter and other materials to thermal features tend to destabilize the physical function of these important resources. Decisions from other park planning projects such as the Commercial Services Plan may add additional visitor use to geothermal areas throughout the year. Overall, the use trend is increasing in the foreseeable future.

Additional Impact of the Proposed Actions. Under current winter use management, minor direct adverse impacts could occur to features near the groomed surfaces for both motorized and nonmotorized uses. Backcountry thermal features sustain minor adverse impacts from skiers. Certain individual features may be at risk, but not predominantly associated with winter recreational use. Under alternative B, there may be increased impacts to the Old Faithful area if winter pedestrian use increases due to enhanced access for this type of visitor. Similarly, in alternative C, with an increase in the type and amount of use and longer seasons, wildlife use of geothermal winter ranges could be moderately affected. In alternative F, since there would be the potential for fewer adverse impacts to geothermal features located along roads closed to use, the overall cumulative impact would be less. In alternative G, there may less overall impacts with the use of mass transit and interpretive opportunities throughout the park. The additive impacts of winter use appear to be relatively small compared to other existing impact sources. The total cumulative effect for all alternatives lies in the range of acceptable impacts with continued administration, trail location, and education. Without mitigation, there could be long-term adverse impacts on individual geothermal features from all impact sources.

Water Resources

Area of Concern. The area of concern includes all watershed areas contributing to water resources within the three national park units. Most surface water hydrologic systems for these park lands originate within the national parks and flow outward onto land owned by other entities. Exceptions to this include headwater streams flowing into Yellowstone Lake from the southeast, and into GTNP from the east. These arise out of predominantly wilderness headwaters on the Bridger-Teton NF. Some of the inflows to GTNP flow through private land inholdings or adjacent private lands. The area of concern is delimited to the outflow boundaries of watersheds from the national parks.

Potential Impact Sources. Current impact sources within the national parks that may affect water resources during the winter include emissions from 2-stroke engines that are

deposited in snow and ice packs. Other winter sources include emissions from wheeled-vehicles that operate on open roads within the parks and backcountry nonmotorized uses that generate human wastes. During other seasons, deposition of petroleum products onto road surfaces from large volumes of traffic can be washed as stormwater into connected surface water systems. Land management activities within parks such as road reconstruction and domestic livestock grazing (GTNP), sand and gravel sources, water use and treatment facilities, and backcountry summer use are also possible impact sources.

Other activities in the park contribute to decreases in water quality and may negatively affect aquatic resources. According to the GTNP Park Resource Management Plan (NPS 1985 and 1995) and the recent Water Resources Scoping Report for GTNP (Mott 1998), water resource issues in the park include high visitor use in the backcountry that results in human fecal contamination, illegal dumping of sewage from boats. Other issues are irrigation practices and water flows and discharge of sewage effluents to ground water. Snowmobile emissions would appear to add a small increment of pollution to other more significant water quality impacts. In YNP inadequate facilities for dealing with sewage are of great concern, and efforts are underway to improve them.

Impact sources from upstream watersheds on adjacent national forest lands do not generally include timber harvest, road construction, or impacts from other legitimate multiple uses of those lands. Since the contributing watersheds are mostly in wilderness, sources could include summer backcountry recreation, wildfire burned areas, and grazing. Private lands adjacent to GTNP could contribute domestic waste, runoff from grazed lands and roads connected to the stream systems. There are no foreseeable changes to this scenario, other than the possibility of lost open space on private lands in or adjacent to GTNP.

Additional Impact of the Proposed Action. Under current winter use management, there has been no measurable impact to water resources or aquatic environments. Therefore, there is no demonstrable addition to the total cumulative impact from other possible sources. The only identifiable potential for additive impact is associated with aquatic mechanisms that could trap non-biodgradable petroleum products, such as lake and reservoir sediments and riparian vegetation. There is no evidence this occurs, but future monitoring should incorporate this study as an objective. In alternative B no net change in cumulative impact would occur. However, there may be a decrease in possible adverse impacts on the Madison River from 2-stroke emission pollutants, as well as an increase in turbidity from sand washing off roadways and entering connected streams. In alternative C, additional amounts of sand could enter the Madison watershed from the Gibbon River when the road along the Gibbon River is plowed. However, fewer pollutants may enter the same watershed because 2-stroke engines will use this road segment one month less in the winter. In alternative D a marginal improvement to the parks' watershed could occur in the long term as reduced emission standards are required for 2-stroke engines in the year 2008-2009. In alternative G elimination of snowmobiles

in the three park units could significantly reduce the risk of degrading water quality or affecting aquatic resources in these headwater watershed areas.

Based on current information, the additive impact on water resources from winter use in all alternatives would not add significantly to overall cumulative impacts. The ability of motorized winter users to purchase bio-based fuels and lubricants in and near the parks may be marginally beneficial by reducing deposition of pollutants into snowpacks. Recommended mitigation is to move some roads away from paralleling rivers to disconnect impact sources from hydrologic systems. The overall cumulative effect of all sources over time has a long-term impact by changing the inherent quality or value of aquatic resources.

Air Quality

Area of Concern. The area of concern includes the airshed described by all three park units and by adjacent Class I areas on national forests. Although ambient air pollution generated at great distances beyond the park boundaries are a concern relative to air quality in the park, it is unreasonable to consider the whole of the western United States as an area of concern. Additional pollution comes from regional industry located within 150 km of the park. Industries include oil and gas processing, power plants, and industrial combustion. Levels of nitrates found in YNP's snowpack can be related to regional industry (Ingersol et al. 1997). Relative to these and other more distant ambient sources, any additional pollution contributed through winter recreational use in the parks is negligible.

Potential Impact Sources. Current impact sources within the parks that could affect park air resources during the winter include emissions from 2-stroke engines and other motorized wheeled-vehicles (or internal combustion engines) that operate on open roads within the parks, as well as wood-burning stoves. During other seasons, human-related sources of pollution include motor boats, gasoline powered maintenance equipment, recreational vehicles, busses, generators, ambient sources, automobiles, campfires, and road material processing equipment. Forest fires in both parks and national forests impact air quality during the summer and fall seasons. There is no known connection between potential sources of air pollution in the winter and potential sources in the summer. Therefore, these sources are not additive as cumulative effects. Effects on vegetation, or other air quality related values from auto emissions are largely hypothetical. Such an impact could be attributed to the large amount of summer automobile use when plants are actively respiring. In alternative G elimination of snowmobiles could significantly reduce the risk of degrading air quality related values in these Class I areas.

Additional Impact of the Proposed Actions. In YNP and GTNP obvious visual effects of air pollution are usually short term and local. The cumulative effect of winter use, added to other possible sources of pollution in the parks, is considered to be short term and localized around parking destination and staging areas, entrance stations, and attractions such as Old Faithful. Effects other than visibility are of concern in these local areas, including health impacts. In alternative B the application of "cleaner" technology could result in a net reduction of cumulative impacts within the area of concern. This would also be true of other alternatives that apply new technology aimed at meeting EPA emission regulations. Conversely, in alternative C any increased use without implementing new "clean" technology would continue present trends with air quality impacts; that is, continued short-term and local negative impacts on visibility and air quality parameters affecting human health. In any alternative, when ambient air quality levels exceed existing standards, plans to correct the situation would be developed and implemented.

Wildlife

Bison

Area of Concern. The area of concern is that which is used by bison for wintering and seasonal migration. Generally, the area includes the corridor and adjacent available winter forage areas in the northern area of YNP and into Montana, and the western corridor along the Firehole and Madison River. The bison issues are mostly beyond the scope of this analysis, and are being addressed in the Bison Management Plan/EIS referred to in *Other Plans and Environmental Analyses*, Chapter I.

Potential Impact Sources. Since the area of concern is tied to bison winter habitat, impact sources include winter uses — motorized and nonmotorized — that displace bison from that particular habitat or render the habitat unusable for them. Activities such as trail grooming that facilitate bison movement in the winter (with less energy expenditure) also facilitate the recreational uses that can stress bison and cause higher energy expenditures. Bison movement along groomed and open roads can lead to the complex economic and social issue of migration to lands beyond park boundaries. Bison have been shown, however, to leave the park more in response to a variety of circumstances, and often not on groomed surfaces. For further evaluation of impact sources refer to the Bison Management Plan/EIS. Actions being considered in the Bison EIS include closing sections of road to winter motorized use and limiting bison use of groomed surfaces.

Additional Impact of the Proposed Actions. Proposed actions may be subject to decisions made in the Bison Management EIS/Plan. For consideration of the total cumulative impact on bison, and how winter use contributes to it, this analysis incorporates the Bison Management EIS and Plan. Refer also to the disclosure of direct and indirect effects earlier in this chapter.

Ungulates other than Bison

Area of Concern. The area of concern includes habitat for various species within the three park units and other seasonal habitat beyond the parks' boundaries. Ungulate species are migratory and some herd units will disperse onto adjacent jurisdictions and land ownerships primarily for winter habitat and forage.

Potential Impact Sources. Other impact sources include those that might occur on adjacent lands. This includes conflicts with other human use activities such as ranching, hunting, and general recreation. Development on private lands, loss of open space habitat, or road construction on other federal jurisdictions are other possible sources. Within the parks, similar actions represent impact sources — housing and road construction, grazing in GTNP, as well as increased recreational use. The most relevant impact sources are those, which occur during the winter, on or off the parks.

The bighorn sheep herd in the Teton Range is declining. In 1999 the Bridger-Teton NF concurred with its permittee, Jackson Hole Mountain Resort, to allow skiing outside the ski area boundary. This makes skiing more accessible in areas occupied by wintering bighorn sheep, and contributes downward pressures on the population.

Habitat losses through development on private lands or road construction on other federal jurisdictions can affect herds that occupy the national parks seasonally. In some cases such losses may render the herds more dependent upon habitat within the parks that is marginally less effective for survival during harsh winters. In this situation, the presence of other impact sources within the parks is critical to herd survival.

Additional Impact of the Proposed Actions. The direct and indirect effects described for winter uses in the parks are key limiting elements for cumulative impacts. Stressed animals or herds whose winter forage options have become limited are likely to be affected cumulatively, through the additional impacts imposed by winter recreation use in the parks. Alternatives that limit all winter recreational use to trails away from thermal areas and close backcountry areas would decrease adverse cumulative impacts on ungulates. Backcountry nonmotorized uses could exacerbate unmitigated, long-term impacts on bighorn sheep in GTNP. In alternative G closure of backcountry areas important as bighorn sheep habitat would help reduce the total cumulative effect.

Federally Protected Species

The type of cumulative effects analysis for federally protected species required in an EIS differs from that required in a Biological Assessment (BA). In a BA cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area. Future federal actions that are unrelated to the proposed action are not considered (FWS 1998). In an EIS cumulative effects include all reasonably foreseeable future actions regardless of what agency (federal or nonfederal) undertakes such other actions (40 CFR § 1508.7).

Areas of Concern. For threatened and endangered species, the areas of concern include:

- The GYA grizzly bear recovery area.
- Existing effective wolf habitat within the three park units.
- Juxtaposed bald eagle nesting and forage areas within the three parks.
- Lynx habitat within the parks.

Potential Impact Sources. Potential impact sources within the areas of concern include any developed facilities or opportunities for human conflict with any of these species when they are present. In the winter this includes any human use near dens, nests, or food sources. For example, impacts to predator species are linked with impacts to ungulates.

Additional Impacts of the Proposed Actions. Potential winter impacts are not considered additive to other impacts that occur at other times and places within the area of concern. Therefore, cumulative impacts equate to those direct and indirect effects from winter use disclosed for these species earlier in this chapter. Most alternatives include activities that take place while bears are inactive for the winter. Therefore any conflicts associated with bears would be minor. Therefore, the additional impact under any alternative would be minor or negligible.

Ungulate management in the parks may affect availability of prey and wolves overall. The draft Bison Management EIS/Plan could affect wolves by reducing its prey base through management removals. In terms of the additional impact of winter use, all alternatives would have negligible or minor impacts on wolves.

Eagle populations are increasing in the GYA under the influence of, or unaffected by, current land management. Additional impacts of the winter use alternatives in the area of concern would be minor or negligible. Nest areas are currently protected in all the parks.

Lynx habitat within the area of concern is fragmented under existing management. None of the alternatives contribute to any greater fragmentation. The effects under existing management are minor or negligible — actions in other alternatives would not add to this condition and could improve it. Existing management includes various practices and measures that mitigate potential habituation and mortality.

Species of Special Concern

Areas of Concern. For all species of special concern, the area considered for cumulative impact assessment, is the collective habitat within the boundaries of the three park units.

Potential Impact Sources. Land use development, including additional commercial services development within the park units, impacts the survival of wolverine and fisher populations. Future road construction or developments in YNP as outlined in the Commercial Services Plan may occur in ungulate winter range. Road construction within YNP could further fragment wolverine and fisher use of home ranges. Commercial developments in ungulate winter range could affect carcass availability, and decrease

available habitat to wolverines and fishers. Hunting and habitat destruction outside the parks has impacted trumpeter swans.

Additional Impacts of the Proposed Actions. In YNP, increased backcountry skiing in remote, high elevation areas could cause displacement of wolverines into less suitable habitats. In YNP this is mitigated in the alternatives (B, D, and E) that limit backcountry skiing to designated routes and trails only; the impact is eliminated in alternative F, which closes the backcountry. In GTNP closures to protect bighorn sheep may be of benefit to wolverines as well. Additional impacts of winter use under all other alternatives are no greater than those occurring under current management. All alternatives would have minor or negligible impacts. Alternatives D and F could improve habitat by removing oversnow trails for motorized use that tend to fragment winter habitat.

Sound

Areas of Concern The area considered for cumulative impact assessment, is the natural soundscape within the boundaries on three park units.

Potential Impact Sources Since individual sources of sound are transient and short lived, the potential cumulative impact on the winter soundscape is those sounds occurring during that time. Sounds other than those that naturally occur in the park units during the winter include the sound of wheeled vehicular traffic along open roads, the sound of oversnow vehicles on groomed routes, aircraft overflights, and sounds attendant to facility developments open in the winter.

Additional Impacts of the Proposed Actions Where open facilities coincide with roads and oversnow motorized activities, the natural soundscape is impacted. There are such areas in the parks where the total cumulative effect is such that it renders the natural soundscape to be seldom evident for most of a winter day.

Cultural Resources

There would be no new cumulative impacts to cultural resources as a result of the continuing existing management.

For All Other Alternatives. Proposed construction could put archeological resources at risk. Such impacts would be mitigated to the fullest extent possible through avoidance and/or data recovery. A loss of historic fabric in structures that undergo adaptive rehabilitation could occur. The construction of visitor facilities, trailheads and trails, or camping sites could intrude upon potential cultural landscapes.